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POPULAR SCIENCE

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April 35c

MONTHLY

PAGE **HOME SHOW**

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What You Should Know About Appliances

New Outdoor Room
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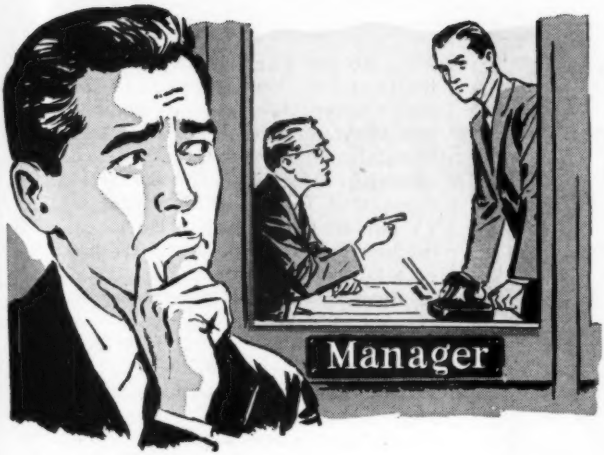

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Letters

Prices of 1956 Cars

You packed a lot of interesting information into that handy little "Score Card" booklet [Feb., pp. 145-160]. But I noticed that the prices you gave don't all agree with those which I have seen in other published lists. How come?

HENRY R. SCHMIDT, Ocala, Fla.

Manufacturers give car prices in various ways. Some include taxes, preparation and handling charges; others do not. As a result, we regret, several of the prices given in the February issue of POPULAR SCIENCE MONTHLY *were wrong. So were some of the prices given in other magazines. As this issue goes to press, manufacturers' practices and prices are being revised again. To compound the confusion, dealers are not bound by factory suggested prices.*

Who Has the Most Motors?

I see in the January issue that Mr. Alan Kogan of Detroit has 22 motors in his house [Letters, p. 20]. Not bad, but he has to take a back seat. I looked around our house and, counting our three electric shavers, found 34 motors all told.

ALEX BROWN, Tucson, Ariz.

. . . We have a grand total of 68 motors (including those in 10 clocks, two dishwashers and a jukebox) under one roof.

J. RAYMOND FRITZ, Newport, R. I.

Report from a Satisfied Customer

I read a lot about the new inventions made for cars today. So I decided I would try them. First I installed a carburetor that guaranteed to save 25 percent on fuel. Then I put in a set of special spark plugs that saved 20 percent. To these I added an intake superduper heater—another saving of 30 percent. Next I added a special automatic transmission guaranteed to save 35

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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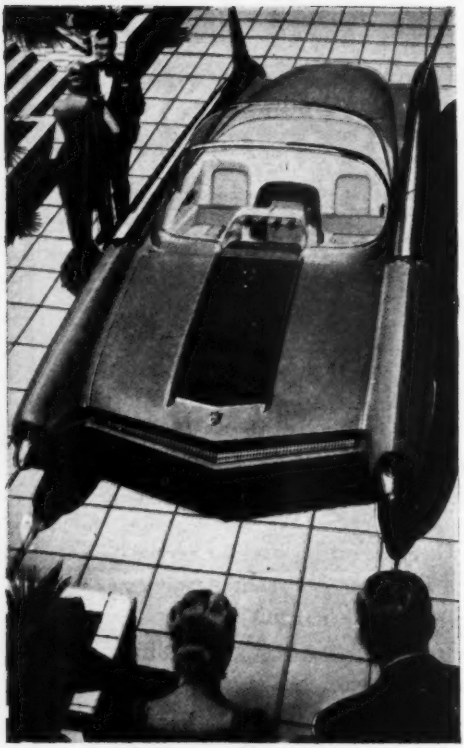

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JOHN BARTOVICH, Brownfield, Pa.

Mines Official Praises Rescue Story

I have just finished reading your accurate article concerning the 1955 National First-Aid and Mine-Rescue Contest at Knoxville [Jan., p. 97]. The photographs were excellent, too, probably the best set ever produced along this line. Please accept our thanks for a nice job.

E. R. NICOLAI, Assistant Chief
Office of Mineral Reports
Bureau of Mines, Washington, D. C.

Big, Bigger, Biggest

You're wrong about that dragline used on the St. Lawrence Seaway [Jan. p. 108] being the world's largest. We have a bigger one—1,250 tons—here in Hibbing. And there is reportedly a still larger one in England.

PAUL PEROCESCHI, Hibbing, Minn.

For a report on a new power shovel that dwarfs all these, see page 106.

Fuel Injection Here Already

Your article on fuel injection in the February issue [p. 140] was most interesting. I am sure you will be interested to know that the Meteor Fuel Injector is currently available for immediate installation as a replacement for a carburetor. It is made by the Saaty Fuel Injector Corp., 1050 Broad St., Providence 5, R.I.

LESLIE D'AVIGDOR, New York City

Look Who's Flatheaded Now

I did a double-take when I read in Ken Purdy's article on the new Corvette, in your February issue ["New Corvette Challenges Thunderbird and Hawk," p. 136],

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that some of the earlier models were powered by a "flathead six-cylinder engine." Chevrolet has always, I believe, made nothing but overhead-valve fours, sixes and V-8s.

JOHN DANIELS, Wellfleet, Mass.

You and the many other Chevvy fans who caught that one are right. Chevrolet hasn't had a flathead engine since 1912.

Just the Facts, Man

When you speak of a Nash being "urged" by a 220-hp. "mill" [Dec., p. 142], you lose my confidence. This is the jargon, not of the serious engineering-minded devotee of improved performance, but of the back-alley hot-rodder whose idea of mechanical perfection is something with several carburetors and the largest megaphone exhausts on the market.

Here's to more conventional—and more correct—terms.

C. A. RAMBOW, Lt. (j.g.) USNR
Bremerton, Wash.

There are new models in language as well as automobiles, and we are intrigued by new ideas—both tangible and intangible.

A Hat Doffed to Martin Bunn and Gus

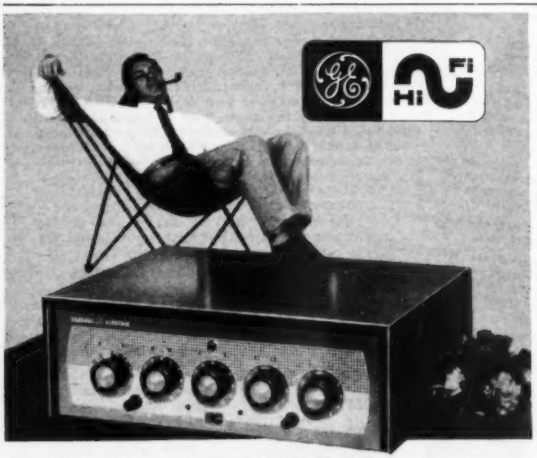
Carrying out an intention of long standing, I give utterance to the enjoyment derived from the Gus Wilson stories.

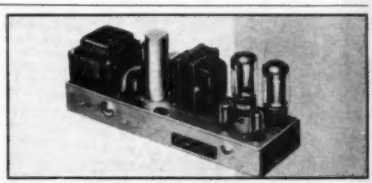
How Mr. Bunn can think up an endless series of situations is more than I can understand. Not only "situations," but another endless parade of human nature, which to me, a man of 71, has a strong appeal. All in all, I doff my head covering to Mr. Bunn and hope he will be around for many years to come.

A. J. WALLACE SR., Collingswood, N. J.

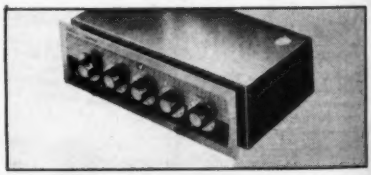
Headless Screws Hold Sanding Table

I found a simpler way to fasten that sanding table ["Drill Accessories You Can Make," Dec., p. 158] to my bench. Instead of angle irons, I put wood screws into the bottom, cut off the heads, and drilled matching holes in the bench top. The table





20-watt Hi-Fi Amplifier and



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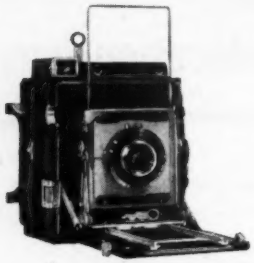

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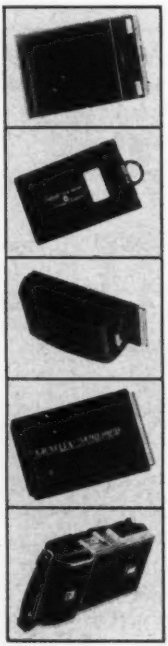

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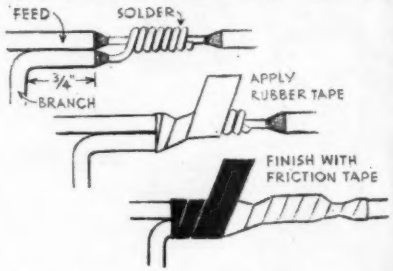
is steady to use when set in the holes, but can quickly be lifted out and put away.

R. E. CZERNY, Hapeville, Ga.

Easier Way to Splice a Wire

The method you show for making an electrical branch splice [Dec., p. 230] is correct, but rather difficult to tape properly, especially for a beginner. The tape has to be weaved in, out and around, making a bulky, unsatisfactory job. Most electricians



bend the branch alongside the main (sketch) so that all the tape can be wound in one direction.

A. SPAGNOLA, E.E., Bronxville, N. Y.

It's a Thunderflash

The picture accompanying "Toy Room Speeds Airplane Production" [Jan., p. 280] shows a model of a Thunderflash rather than a Thunderstreak.

RICHARD MCDONALD, St. Louis

You're right. The solid nose, which contains camera equipment, identifies it as a Thunderflash reconnaissance model of the F-84. Air-intake ducts are at the wing roots. In the Thunderstreak fighter-bomber, the air intake is in the nose.

Calling the South Pole

Your article "Secrets of the South Pole" [Jan., p. 102] gave the call letters of the amateur radio station at the South Pole as K4USN. The correct call is KC4USN. The other stations, KC4USA, KC4USB and KC4USV will be located at Little America Base, Marie Byrd Land and McMurdo Sound, respectively.

ED SCHWARTZ, K6JHR, Burbank, Calif.

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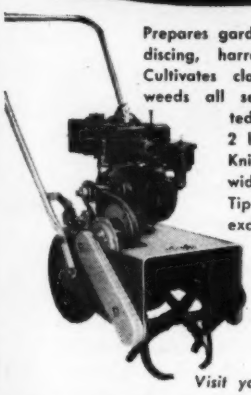

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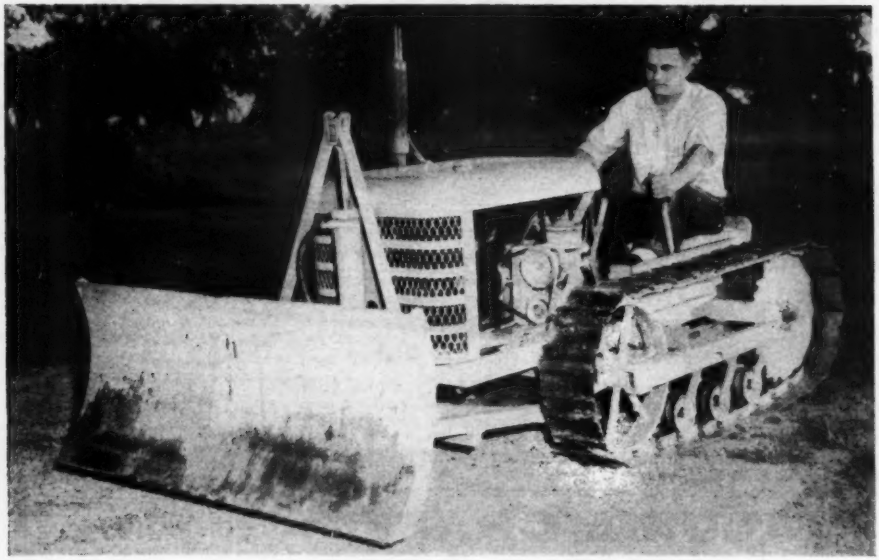
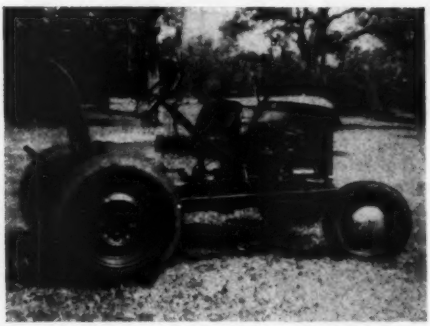


Track Type. It took a year of Charles A. Weber's spare time to build his seven-hp. tractor, outfitted with an electric starter and a hydraulically operated blade. The Elkhart, Ind., craftsman made the track from flat bar steel and case-hardened bushings and pins. A 20:1 gear reduction gives five-m.p.h. speed.

Hodgepodge. The transmission for this tractor came out of a Ford; the rear axle from a Studebaker; a Chevrolet furnished the brakes, and front wheels were a motor scooter's. It is powered by a 3.6-hp. Kohler engine. Builder Norman E. Baker of Sigel, Ill., rides on a three-inch-thick foam-rubber seat covered with plastic.



Bargain. A stripped-down '46 Crosley provided most of the parts for this tractor: engine, frame, steering wheel, transmission and differential. It cost Ralph Richards of Tampa, Fla., $50 to make. The comparatively slow-turning engine needed only a 6:1 chain-drive reduction gear to produce plenty of pull.

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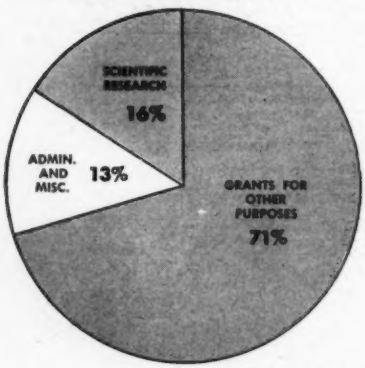
POPULAR SCIENCE MONTHLY

LATE NEWS...

Astronomers may scratch one planet off their list. A new measurement gives Pluto a "day" equal to 6½ Earth days, too slow for a true planet so distant from the sun, according to Dr. Gerard P. Kuiper of Yerkes Observatory. This confirms suspicions raised by the strange tilt of Pluto's orbit—all other planets move in nearly the same plane with orbits that are practically concentric. Dr. Kuiper would demote Pluto to the status of a satellite—a moon that originally belonged to the neighboring planet Neptune, but that has escaped.

Money for science. Research is less dependent on the great philanthropic foundations than you might think, a new survey shows (see chart below). Even the wealthiest foundations spend only a small part of their funds on scientific research—the rest goes for other good works, such as education. And their total expenditure of about $25,000,000 in 1953 was minute compared to the national research bill of at least $5,000,000,000. What the foundations do invest, however, often returns unusually high dividends, since they can act more quickly than government agencies and allot sizable sums to exploit new ideas.

Science Gets Small Cut of Foundation Gifts



National Science Foundation

A machine has written a book—a 198-page lexicon listing possible names for new drugs of Chas. Pfizer & Co. Instructions—such as the number of syllables, and preferred letter combinations such as "cin" and "phyl"—were fed to an IBM 702 electronic computer, which typed out 42,000 names from Abechamycin to Ywuvite in two hours. The machine occasionally cusses, so a human editor is still needed to censor its "writing."

A diesel Plymouth may answer your call for a taxi in England. The bodies, Plymouth Belvederes, are assembled in Belgium and shipped to England, where 55-hp. Perkins diesel engines are installed.

The jokes you like and the way you laugh at them reveal a lot about your mental health, report Yale professors F. C. Redlich and J. Levine. Professor Levine says, "The basic themes of humor are the same everywhere. The significant differences [in sense of humor] are between individuals, and they reflect deep-seated aspects of personality and emotional development."

Wheels won't spin on ice or mud with a new non-slip differential available for Studebaker light trucks. It works opposite to an ordinary differential, delivering power to the wheel that has the more traction—is harder to turn. This is the first such device offered as factory equipment. (A similar differential is on some '56 Packards.)

Good book. Antarctic exploration, from Captain Cook in 1772 right up to the present international attack on the frozen continent, is excitingly reviewed in *The Antarctic Challenged* (John De Graff, $4.50), by Admiral Lord Mountevans. The Admiral knows what he writes about—he was with Scott on the 1910 expedition.

Off to the dance in a truck. It helps if it's as handsome as this GMC "Town and Country."

You'd Hardly Know They're Trucks

In color, styling, neck-bending performance—new pickups are stealing passenger-car thunder.

By Frank Rowsome Jr.

ALL of a sudden, pickup trucks are real gone. For decades a frumpy, plain-Jane vehicle, the pickup has blossomed like a butterfly coming out of winter quarters. You have to see one to believe it.

You can now buy a pickup with *five inches* of foam rubber on the seat; with enough horsepower to out-drag most passenger cars; with colors that go *boinng* a hundred yards away; and with such adjuncts to contented trucking as white sidewalls, sound-deadened cabs, quilted plastic upholstery, back-up lights, tinted glass and fancy new suspensions that skim off the familiar jowl-shake on washboard roads.

How come the dowdy pickup has pulled off this chrysalis stunt? The answer—rather unsettling to people with an image of truck drivers as near Neanderthals—is that people like trucks that way. *Why* they do calls for a closer examinations of who drives pickups, and of

GLEAMY GAUGES report how things are with the 180-horsepower OHV V-8 under the hood of this GMC pickup. That selector quadrant is part of a heavy-duty Hydra-Matic transmission.

NO CRUDE CHAINS tether this tailgate. These recessed handles and disappearing steel cables are neater looking, though whether they'll work as handily on the farm will be argued.

TUCKED IN A POCKET behind a hinged bumper section is the spare tire of this GMC. "Tennessee hardtops," slang for dolled-up trucks, are now often ordered with whitewall tires.

The prettified pickup is still a working truck.

the various reasons for driving them.

Still sturdy. It would be an error to assume that pickups have gone girly-girly. They still *behave* like no-nonsense vehicles, even if they are beginning to

Fancy pickups are now made by all the manufacturers

Though long a factor in selling light trucks, comfort features, colors and styling are now more important than ever. The chief U.S. makers, in order of sales, are Chevrolet and Ford, followed by GMC, International, Dodge, Willys and Studebaker. All the makers offer de luxe choices as added enticements to the prospective buyer. Some of the plush workhorses are shown at right and on page 96.

INTERNATIONAL calls this salon its "DeLuxe Comfo-Vision Cab" without a blush. The quilted door panels are vinyl. Twelve main color options are available, each with matching trim.

New balance-weight front suspension smooths out ride without impairing the load capacity.

look like cheese dreams. Transmissions continue to give the keening cry of gears; handling is still solid, and a brisk door slam still sounds like an explosion in a sheet-metal shop. Unlike some passenger-car members of the automotive family, pickup trucks are rarely "tender"—Detroit's polite word for any vehicle that needs continual tinkering to stay tuned.

Workhorse. Behind its three-passen-

DODGE suggests that whitewalls add a special cachet to the dog-catering business. Actually, fancied-up trucks are often bought on the idea of enhancing the prestige of a small business.

FORD puts forward the theory that its truck is nothing to be ashamed of in swank surroundings. Inside the "greenhouse," in customized version, are deep foam rubber and insulation.

BOX IN BACK carries ordinary loads, but either grain-tight steel sideboards or stake sides to corral livestock en route may be speedily fitted. This particular pickup is an International.

ger cab, a pickup totes an open steel box about 6½ to eight feet long and 4½ feet wide. The load placed in it is not supposed to exceed 1,000 pounds (1,500 pounds on some models), but this is largely a pious declaration by the manufacturer for warranty purposes. Pickups are notoriously affable about overloads, being aided in this in recent years by huskier tires and by stronger or two-stage rear springs.

What goes in the steel box is very nearly a roster of human activity. Farmers are the biggest single group of buyers (pickup sales executives can watch the crops come in by studying the sales pins on a map), but small business, including the retail and service trades and the construction industry, is a close second. Pickups are popular all over the country—almost half a million were sold last year and some four million are believed to be in use—but the Southwest, with its big ranches and its oil fields, has the most per capita.

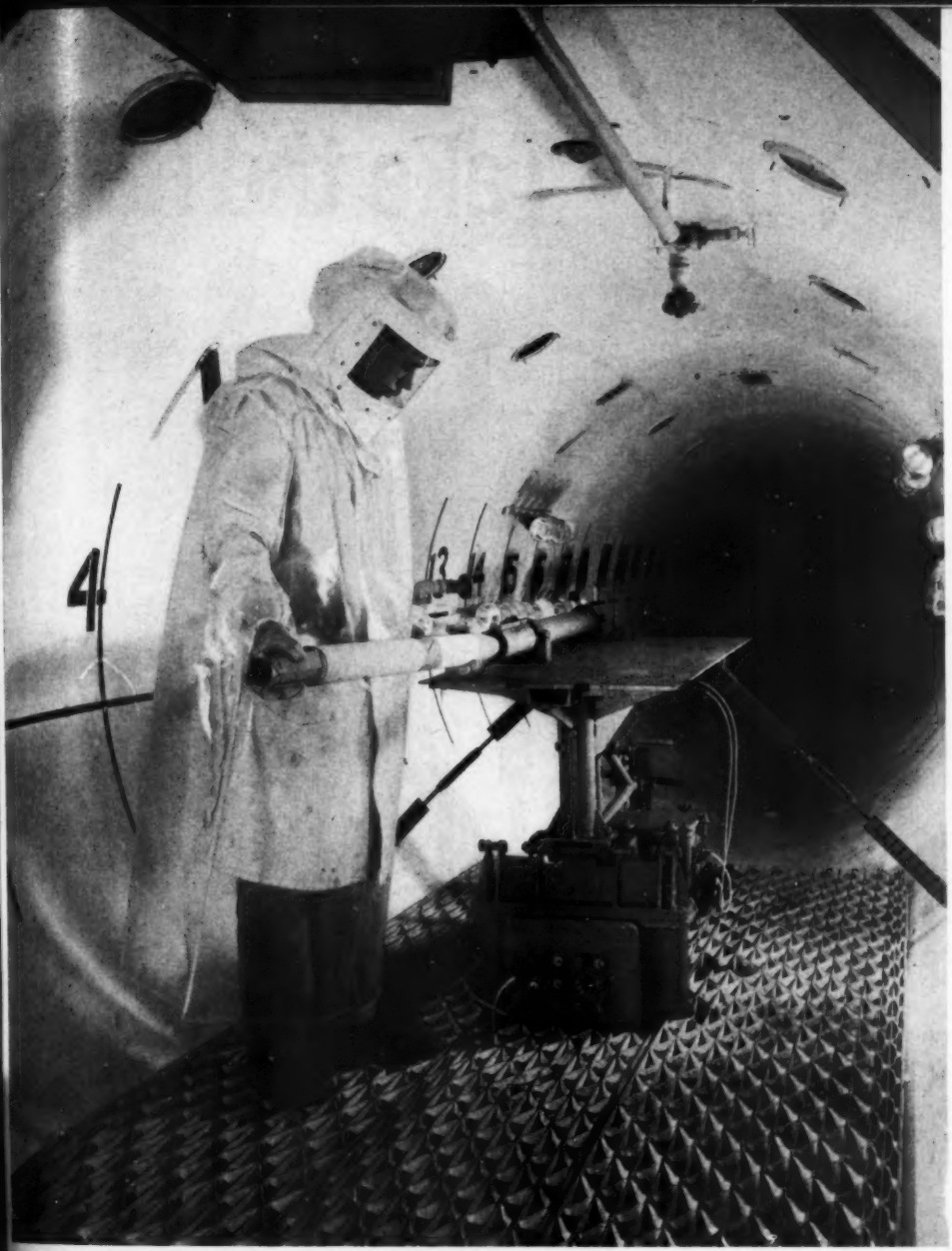
Everyman's truck. A basic reason for this popularity is that the pickup is widely adaptable. Slide posts into the corner stake pockets and you can fit special sides and tops, covering it with canvas like a latter-day prairie schooner. Or slip in a dump body to take loose loads; add a winch, hoist or rigging gear; attach tool lockers, ladders and side racks; or rig it up with a water tank or fire-fighting equipment. A pickup tows house trailers better than most passenger cars, but if fitted out with bunks and a kitchenette it becomes its *own* trailer, prized by big-game and uranium hunters for its off-highway capabilities (four-wheel drive is an optional item on some pickups).

Women drivers are partial to pickups, too, and put on a considerable percentage of total pickup mileage. Pondering the way buyers have gobbled up pickups in recent years, resident thinkers in Detroit have theorized that the vehicle should actually be a kind of realistic station wagon: a dual-function car that can either haul good-sized loads over bouncy back roads or transport people comfortably to town via the main highway.

For people, too. The pickup's prettification arises, of course, from this second function. Used like a sedan to go to church, school, or the movies, it merits sedan attributes in performance, comfort and colors. (Some of the latter currently include Flame Red, Nocturne Blue, Goldenrod Yellow and Meadowmist Green.)

If Mom takes the pickup to get to an Eastern Star meeting, the foam-rubber seat and improved ride are sure to be welcomed. If Bud takes Selma to the school dance, he's going to enjoy a "draggin' wagon"—and some of the hotter new jobs can click off a zero-to-60 time of around a dozen seconds, dizzy going for any beast of burden. And Pop—once he gets over the odd feeling of entering a two-toned cab in his work clothes—is going to find that underneath the finery the pickup is still the handiest hunk of machinery around the place. END

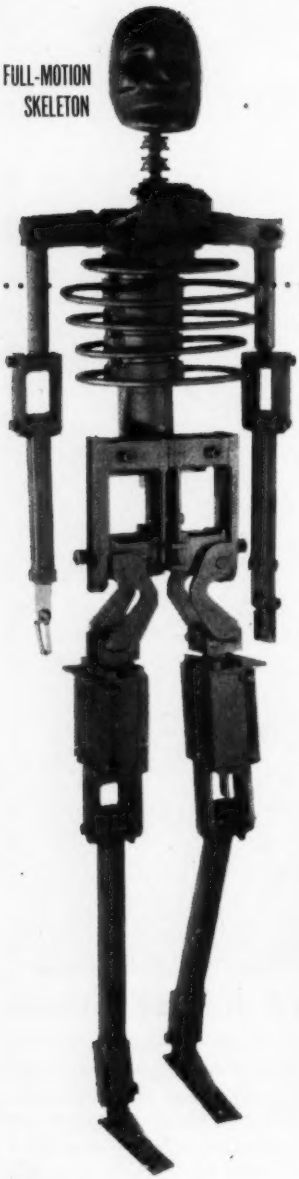
CAMEO CARRIER is Chevvy's name for this job, and don't think for a moment that the resemblance to a Cadillac is purely accidental. Many of the body parts are made of special plastic.

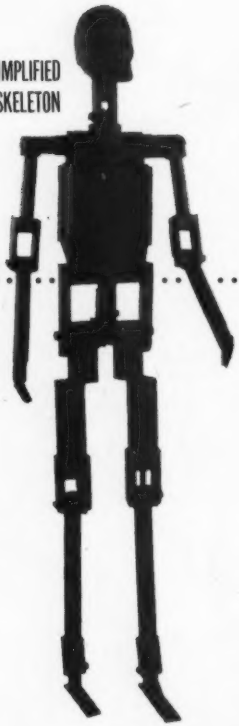


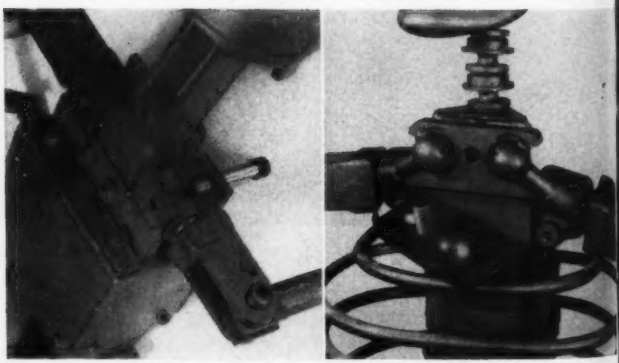
Airplane Rockets Fired and Filmed in Test Tunnel

IN CHEMICAL-PROOF gloves, slicker and helmet, this technician loads an aircraft rocket for test firing. The 110-foot tunnel, at North American Aviation's Rocketdyne Division, has a heavy armor-steel plate at the far end. Ports through which high-speed movie cameras record flight data are in the ceiling and right wall. The numbers correlate time and distance. Firing is controlled from a blockhouse at the near end through the electrical terminal box under the launching table.

They Take the Rap







ROTATION AND BALL JOINTS, shown in detail above, enable full-motion skeleton like the one at the left to duplicate human body motions under severe impact conditions.

for You

BADLY BATTERED, this dummy gave his "life" while testing high-speed ejection from a rocket sled. Air Force scientists are studying telemetering equipment that is inside the torso.

THERE has been some criticism in industry of machines taking jobs away from men. But to date no one has complained about the robots pictured here. These test dummies are man's stand-in at taking the beatings of plane crashes, automobile smashes, and catapult shots from ejection seats of supersonic jets.

Today these robots are kept busy testing safety devices and structures that may save human lives in high-speed accidents. To meet the demand for human substitutes, the Alderson Research Laboratories of New York has developed modular anthropomorphic test dummies made up of quickly replaceable parts.

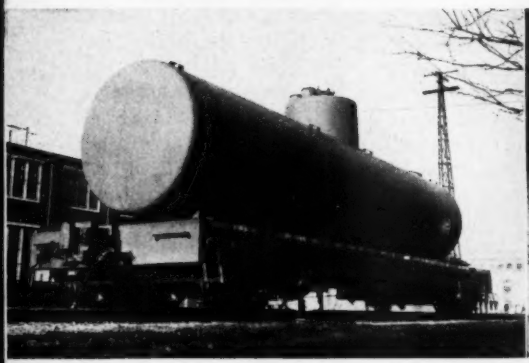
The skeleton, made of rugged steel bars and plates, welded together, is covered with molded vinyl plastisols which simulate the soft tissues of human flesh. The standard model, shown at far left, can duplicate all the major motions of man. He stands six feet one inch high, weighs 200 pounds and comes dressed in blue cotton coveralls and heavy-duty oxford shoes. His skull is a large aluminum casting, and he can be instrumented with an "intelligence" consisting of accelerometer, rate gyro, telemetering equipment, recorders, and pressure devices.

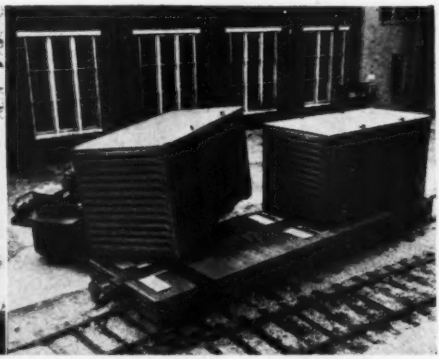
Huge Retriever Picks Up and Brings In Disabled Landing Craft

ELECTRIC motors in waterproof housings in each 10-foot wheel propel this big machine. The Army is testing it by using it to recover landing boats grounded or sunk in offshore operations. The 75-foot LeTourneau retriever can straddle a 67-ton vessel with its U frame, lift and carry it to deep water or dry land.

Solar Radio Runs 250 Days in Dark

THE pocket sun-powered radio at left weighs only 10 ounces and will work 500 hours without recharging. If used two hours a day, it will run 250 days in total darkness. It contains a miniature storage battery, four transistors and seven solar cells. Built by General Electric, it is not intended for production.



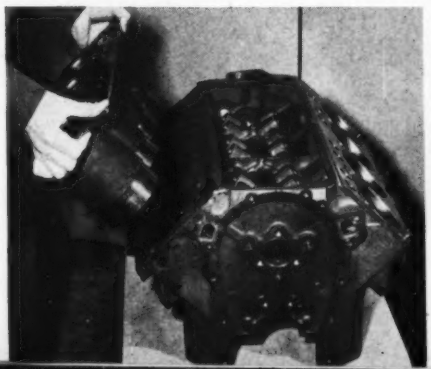


Railroad "Convertible" Has a Single Base for Many Bodies

ALL-PURPOSE flatcars weighing and costing half as much as standard equipment, and only two-thirds as long, will soon be in use on the Rock Island Railroad. Called the Adapto by American Car & Foundry, the new piggy-back can carry tank, box, gondola, hopper, caboose and other interchangeable bodies.

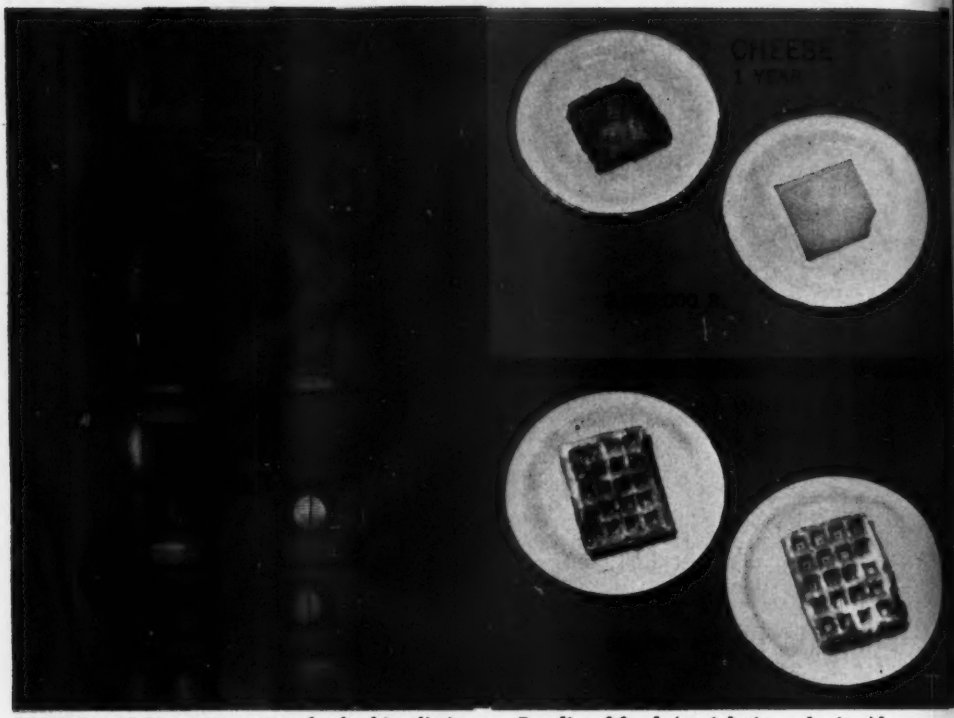
Billionth-of-a-Second Timer Is World's Fastest Stop Watch

DESIGNED to strengthen and measure the flight of atomic particles, this electronic device can measure light flashes less than a billionth of a second apart. The experimental photomultiplier tube developed by Westinghouse is a super stop watch run by an electron "chain reaction." Commercial sizes will be smaller.

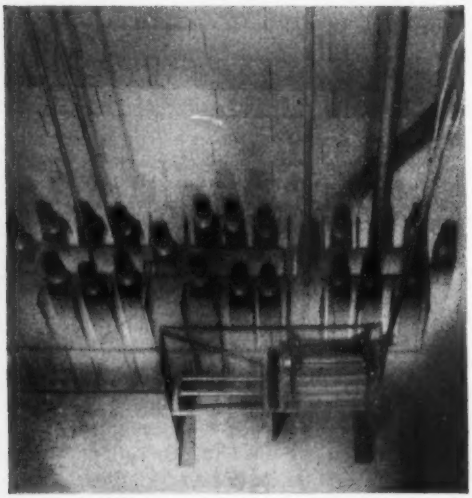


Engine Gets Pull-Out Cylinders

CYLINDER banks are separate units in this engine block said to be suitable for die-cast aluminum blocks now under research by automobile makers. Perfect Circle, piston-ring manufacturers, designed it in an effort to adapt truck-cylinder liners to passenger autos.



POWERFUL GAMMA-RAY SOURCE for food-irradiating experiments, seen above by its own eerie glow, is an underwater assembly of spent fuel rods from Materials Testing Reactor (MTR) in Idaho. Below, revolving rack holding food in can is lowered beside assembly. MTR's rods, one of many radiation sources on trial, irradiated the cheese, ground beef, waffles and corn that are pictured here.



Irradiated foods (at right in each view) keep

Atomic

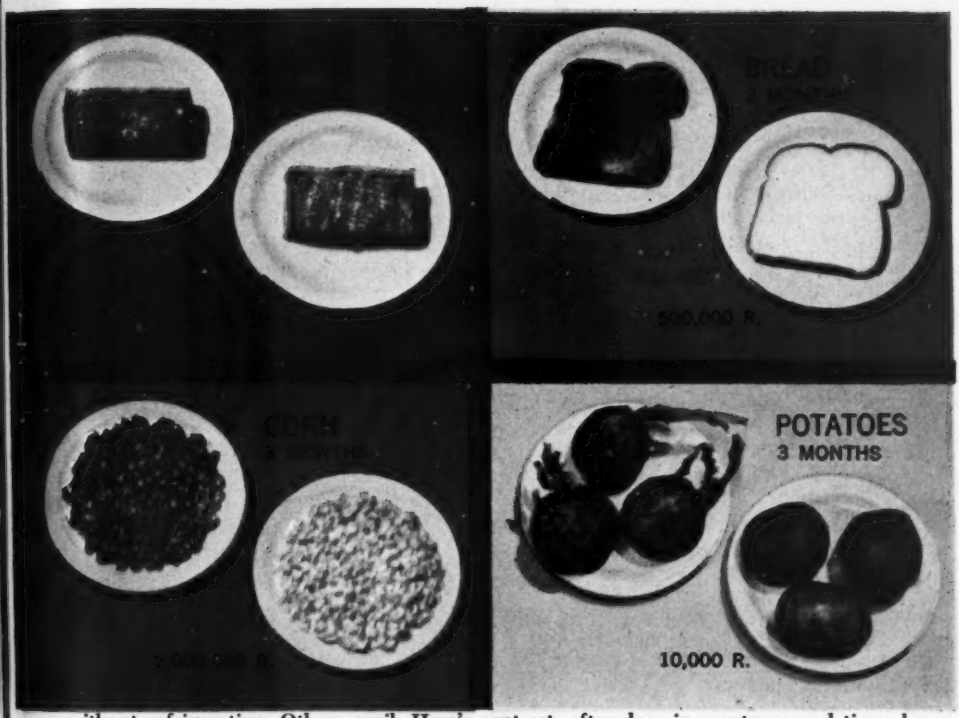
$10,000,000 gamble backs a way to prevent spoilage without any refrigeration.

By Darrell Huff

"PUT that hamburger back in the refrigerator before it spoils," my wife advised. "What're you doing, dreaming?"

She had me there. After looking into something called radiation sterilization, I was absent-mindedly living in a world that we may all inhabit soon. It's one in which meat no longer spoils in a day or a week, bread won't mold, and fresh fruit and vegetables stay fresh.

That's what's coming in atomic



without refrigeration. Others spoil. Here's contrast, after dose in roentgens and time shown.

Rays Keep Food Fresh

energy, they tell me. You take a pork chop, or a bunch of asparagus, and expose it for a few minutes or seconds to atomic radiation. It could be gamma rays from a reactor's spent fuel rods, or an electron beam from a high-voltage machine. The rays kill bacteria, mold, every living thing that makes food decay. So then, I told the wife, your pork chop and asparagus don't spoil.

"Hey, that sounds handy," she said. "I could buy fresh meat and vegetables for weeks ahead and not worry about their keeping."

"Nice for camping trips, too," I added. "Take along steak and chicken for a week or two, and you won't need six iceboxes."

"Is this really going to happen, or is it just somebody's wild pipe dream?"

"Uncle Sam's betting $10,000,000 or more that it can be done. The Department of Defense is putting that much into the idea, currently at the rate of about $1,125,000 a year."

"What's this got to do with defense?"

"Suppose trouble starts, like Korea, and the GIs move in. Way it's been, they live for months on canned rations, until refrigeration ships catch up with them, and mobile refrigerators can be dragged ashore. This way they'll get fresh eats wherever they go.

"The Navy is for irradiated food because it will actually boost their warships' cruising range. Carriers and cruisers won't need to stop and take aboard perishable food so often. That will count

all the more with atomic-powered ships that would have practically unlimited range otherwise.

"The Armed Forces together buy nearly two billion dollars' worth of perishables a year, 2,750,000,000 pounds of fresh meat alone. Keeping just one fighting man's share of it refrigerated, they figure, costs $40 a year. If irradiated food can save as little as a fourth of that, it will cut the cost of feeding a 2,000,000-man army by a tidy $20,000,000 yearly. So, all 'round, it looks like a potent new atomic weapon."

"But will it all be a military secret, then, like atom bombs?"

"No, sirree. Everything about this irradiated-food business is absolutely *non*-secret. All the packers and canners, everybody who makes our eatables, will be encouraged to use the processes that they are working out."

"Who are 'they,' anyway?"

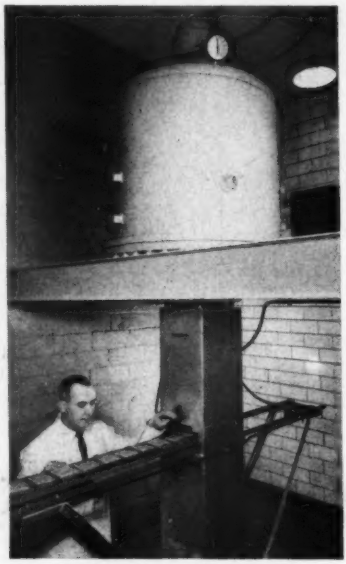
"The idea's being developed by the Army Quartermaster Corps' Food and Container Institute in Chicago. Teamed up with it is some of the top U. S. talent—about 40 groups of researchers in universities, foundations and private industry, plus key Government agencies like the Atomic Energy Commission."

Here are highlights of what they've done so far and with what success:

As Exhibit A you can see for yourself, in color photos, the results of some food-irradiating trials. Five different foods were kept for weeks or months at room temperature, without visible deterioration, after getting the doses of radiation shown. Irradiating potatoes, to keep them from sprouting while they are in storage, was another twist in the process.

The pictures don't mean that each and every one of these irradiated items would pass the dinner-table test.

"Cold sterilization" with radiation contrasts with cooking food an hour or more, at 240° F., in conventional canning. Eliminating this destructive heat sterilization should help preserve fresh foods' flavor and texture. However, radiation itself in large amounts can affect some foods' flavors.



ELECTRON BEAM of million-volt GE machine sterilizes food in experimental setup, which might be model in miniature of a future production line.

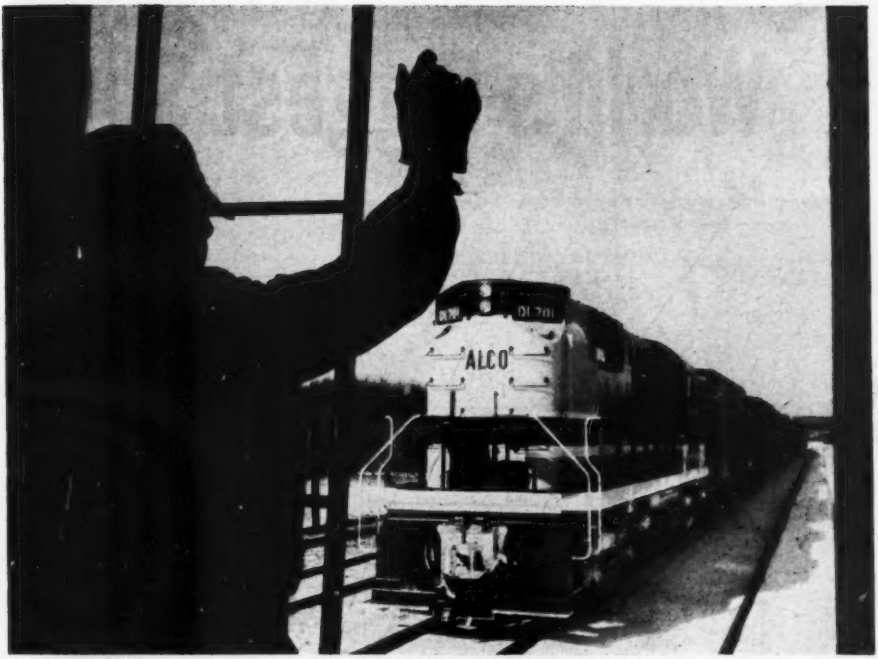
The spectacular sort of thing, making "perishables" keep outside an icebox, calls for *total* sterilization – killing every last microorganism in the food. That takes a whammy of a couple of million roentgens of radiation. Since 400 to 500 roentgens kill an average man, you can see how tough those babies are.

Flavors of a lot of foods stand up nicely to even a two-million-roentgen jolt, the researchers find. On this list of most-promising items for irradiation they put bacon, chicken, pork, beef liver, codfish cakes, green beans, broccoli, asparagus, carrots, waffles; and there are several more.

Other foods, "radiation-sensitive," can't take all those roentgens. Milk, a horrible example, gets a burnt taste. "Off" flavors or odors likewise make cheese, frankfurters, and orange and lemon juice unsuitable for total sterilization.

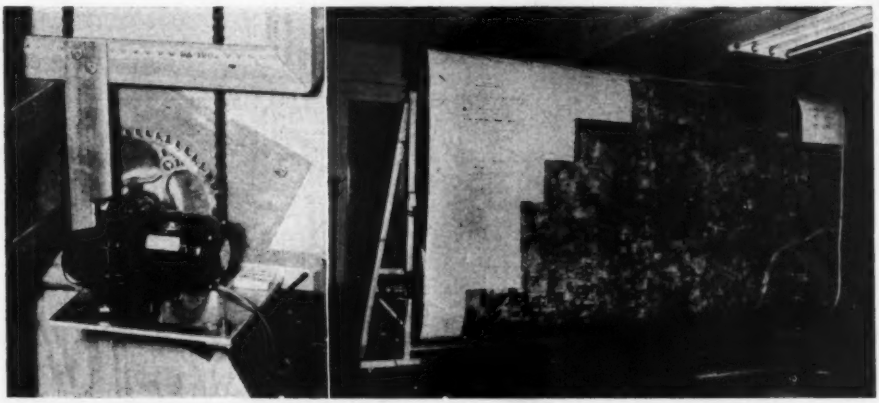
In between these extremes there's a tantalizing group that almost makes the grade—including beefsteak, lamb chops, corn, peas, bread. Powerful radiation just slightly impairs flavor, odor, color or texture. Currently experimenters are trying to upgrade these in-between items,

[Continued on page 248]



New 1,800-Horsepower Diesel Can Pull Heavier Freight Trains

REDESIGNED and souped up with a brand-new V-12 engine, the latest Alco road-switching locomotive can haul 12 percent more tonnage than the model it replaces. Officials of 25 railroads watched the 1,800-hp. diesel do its stuff in recent tests near Schenectady, N. Y., then placed orders for 100 similar engines.



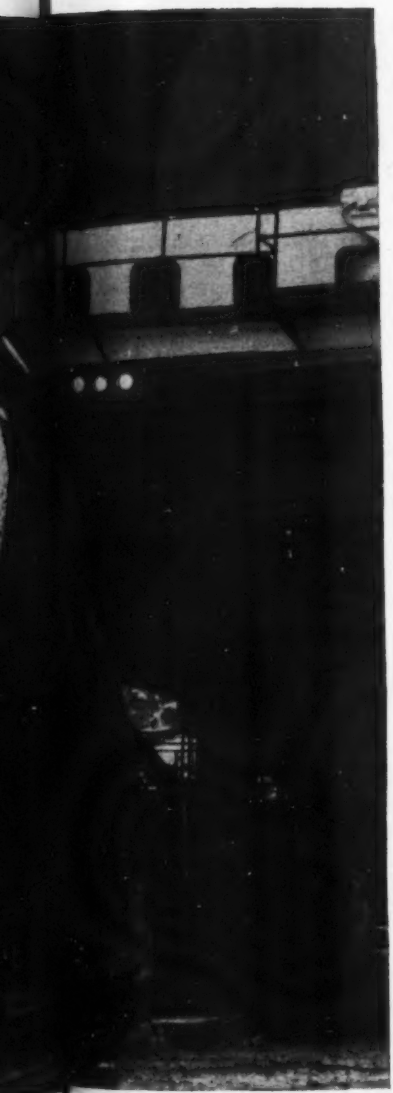
Motorized Rollers Unfurl 15-Foot-Wide Photo-Mosaic Map

THIS photographic map of Orange County, California, mounted on 15-foot drums, is made easy to read by the little motor shown at left. It turns the rollers to put any section at eye level. Some 400 prints 36 inches square were mosaicked into the map. It took Pacific Air Industries eight months to complete the job.

World's Biggest Shovel

TOYLIKE LOAD for the super-shovel's 60-yard bucket, these two automobiles represent only 1.2 percent of its total lifting capacity. Made of lightweight but tough alloy steel, the big scoop and its 100-foot shovel arm are welded into a single unit, hoisted by twin cables.

Digs 125 Tons a Minute



Largest self-propelled land machine ever built in the U. S., the Mountaineer lays bare coal seams 90 feet below the surface.

By Henry B. Comstock

A POWER SHOVEL so big that it has an electric elevator to hoist its crew to their stations inside the cab has just gone to work in the coal fields of southeastern Ohio. The huge earth eater weighs as much as 1,800 automobiles. The tip of its boom reaches as high as a 16-story building. Its winding machinery cab could hold two good-size houses. A single scoop of dirt dumped from its bucket could completely fill your living room.

The "Mountaineer"—that's what the Hanna Coal Co. calls its $2,600,000 super shovel—was built to these gargantuan proportions for a good reason.

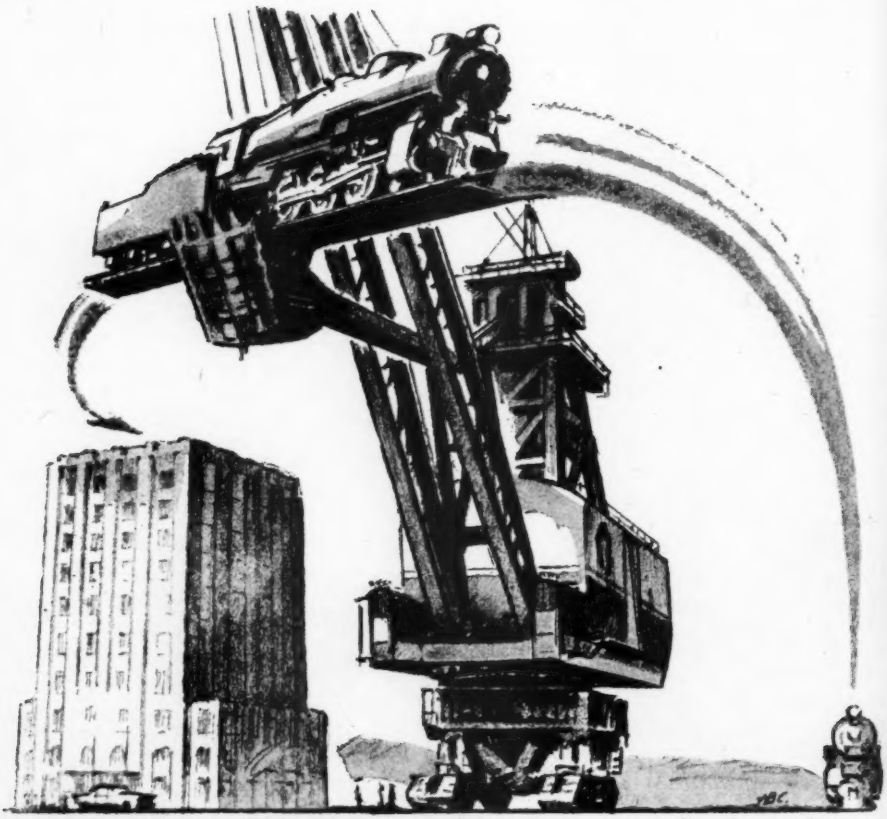
Underlying the rolling hills on the west side of the Ohio River opposite Wheeling, W. Va., there is an almost horizontal vein of soft coal 4½ feet thick. Back in 1940, Hanna began strip-mining this coal, where it lay close to the surface in a valley near Cadiz, Ohio. The operation then, as now, called for a big shovel to

ALL-ELECTRIC "Mountaineer" uses as much juice as a town of 6,000 people. Power is fed to the giant shovel through a four-inch cable.

SHOVEL OPERATOR gets $13,000 a year, earns it by digging nearly 22 million tons of dirt and rock. His control compartment is electrically heated in winter, air-conditioned in summer.

remove the earth above the seam so that a smaller shovel could pick up the coal. Working back and forth along the base of the excavation, the big shovel swung each bucketload of dirt and rock through a half-circle across the exposed coal and dumped it into the mined-out area.

Bigger hills—bigger buckets. Hanna's first earth-stripping shovel at this Georgetown Mine had an eight-yard-capacity bucket. It chewed its way into the hills until the overburden (the soil rising above the coal) was 45 feet deep—the shovel's maximum working limit. Hanna bought another shovel more than twice as large. It, too, reached its limit, at a pit depth of 55 feet. Then four giants with 35-yard buckets were assem-

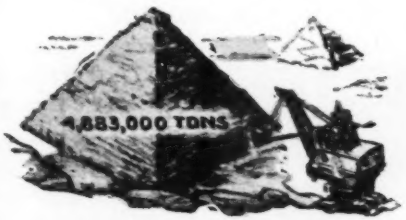


FORTY-FIVE SECONDS is all the Mountaineer would need to lift a 250-ton locomotive 100 feet in the air, swing it through a 300-foot arc and set it down on top of a 10-story building.

bled at Georgetown. Although they can handle up to 70 feet of overburden, Hanna engineers took a look at the still-uptilting countryside ahead and went into a huddle with the machinery designers of the Marion Power Shovel Co. and General Electric.

Last summer, the result of that conference began to roll into Georgetown in sections. It took 125 freight cars to handle the Mountaineer's parts. Among the more spectacular items were the eight crawlers upon which the monster now lumbers up and down the coal field as fast as a man can walk. Each of these crawlers weighs as much as a heavy Army tank.

Elevator service. Sixteen motors, with a combined horsepower equaling that of a Victory ship, went into the assembled cab. The kingpin upon which the cab pivots is so big around that a three-man elevator passes right up through it, making it safe to board the huge machine even when it is swinging through its arc.



MOVING ALL OF THE STONES in the great pyramid of Cheops would be merely a 25-day job for the Mountaineer. It handles more than three times its own weight every hour.

When one of the Mountaineer's shovel operators takes over for an eight-hour shift, he looks out at the bucket ahead through a giant picture window three stories above the ground. There's a telephone, connected to stations on all of the cab decks, beside his heavily upholstered chair. He can also talk, by short-wave radio, with other shovels in the pit, the supervisors' cars and the mine office.

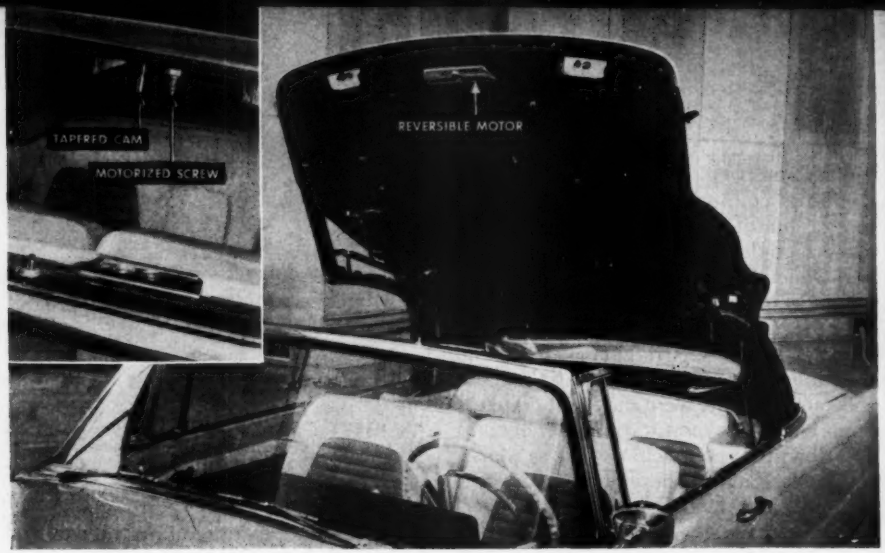
The shovel controls are no more complicated than those in your automobile—only two foot treadles and two hand levers. Through them the operator holds the reins on the 12,000 horsepower used to drive the crawlers, rotate the cab and hoist the bucket and boom.

AS HEAVY AS A DESTROYER, the 2,750-ton Mountaineer cost plenty to build: nearly $1,000 a ton. It takes four motors totaling 1,000 horsepower, to drive its eight crawlers.

That boom presented a special problem. It couldn't be built of ordinary steel. Its weight and 150-foot length would have overbalanced the cab. So a light but exceptionally tough alloy steel was used. In addition to paring down weight, this alloy was particularly suited to welding—and all of the seams and joints on the Mountaineer are welded.

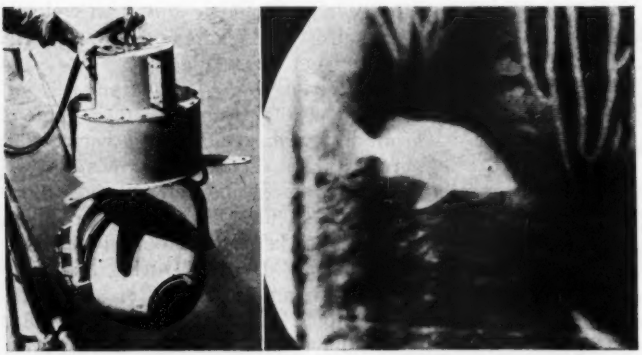
Thirty-year schedule. Hanna is already working its shiny new shovel around the clock. Only that way can it earn its keep: $1,000 a day in amortization and interest charges. Officials figure that there's enough coal left in "them thar hills" to keep the Mountaineer busy for the next 30 years. During that time she'll wear out nearly 82 miles of 2½- and 3⅝-inch wire rope (her hoisting cables have to be replaced every two months). At five dollars a foot, that item alone will come to about $2,160,000.

LOWER FRAME OF THE SHOVEL is shown here before the rotating cab frame was set on. Pockets at the corners are for hydraulic jacks that automatically hold the Mountaineer level. END



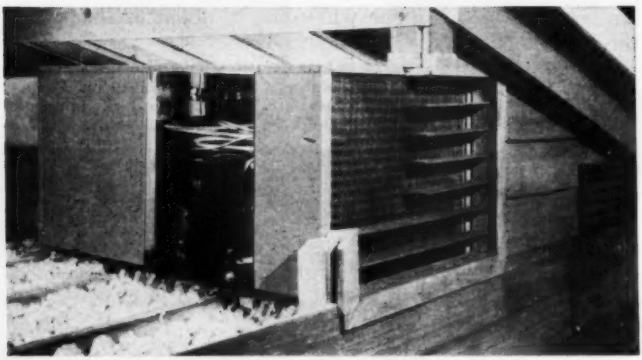
New Convertible Robot Top Locks in Place Electrically

HERE is another push button to make motoring easier: a self-locking top on all new Lincoln convertibles. Operated by a reversible electric motor, two motorized screws on the leading edge of the top, guided by tapered cams, clamp the top to, or release it from, a bar across the upper edge of the windshield.



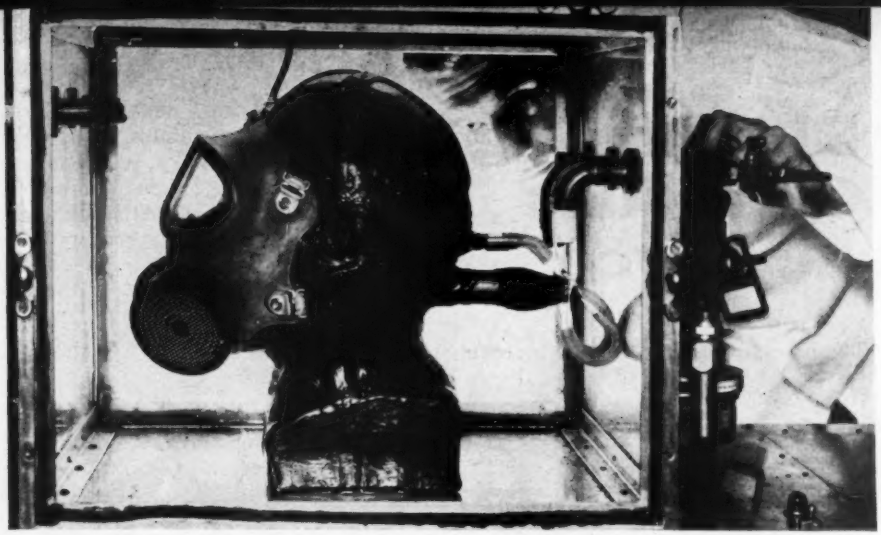
TV Puts Its Eye on Fish at Home

AN UNDERWATER TV camera, at far left, gives Fish and Wildlife Service aids a look at fish on the bottom. Practical purpose: study of fishing gear in use, its effect on habitat, and how some fish escape from nets.



Central Cooling Installed in Attic

THIS unit can air-condition a house from the attic or basement. Made by Lennox Industries, Marshalltown, Iowa, it needs no plumbing. The fan draws air through the condenser, which doubles as a rain trap.



Rubber Head Helps Atomic Scientists Protect Workers

To TEST face masks that guard workers against radioactive contamination, scientists at the Hanford, Wash., plutonium plant devised this "hot" head. Pumps inside the rubber form make it "breathe." To gauge a mask's efficiency, a filter in the head's "windpipe" collects radioactive particles that seep through.

Foot Power Opens Mailbox

A BOON to people who mail letters while carrying bundles, a pedal-operated mailbox is being tested by the Post Office in Washington, D.C. If the device proves rugged under heavy feet, it will be installed gradually in other cities.

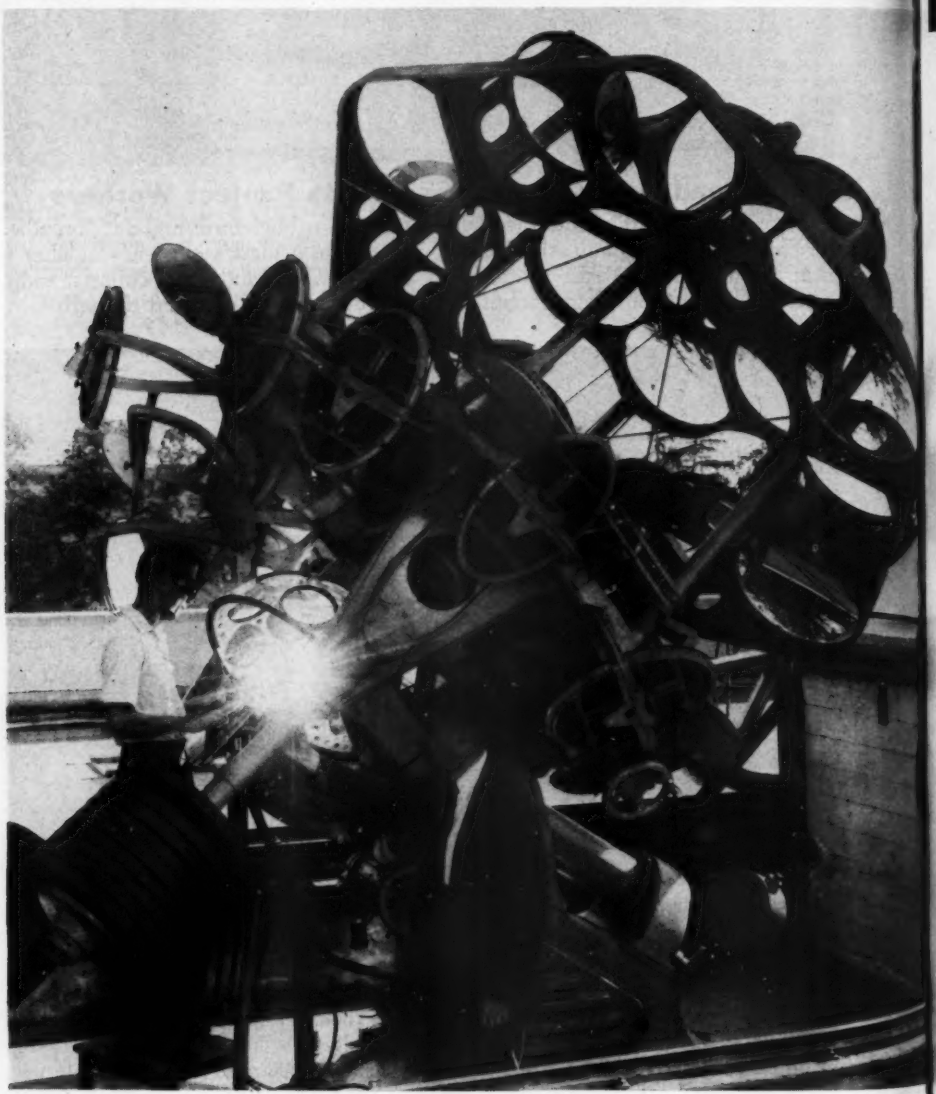
Army Shows New Atomic Rocket

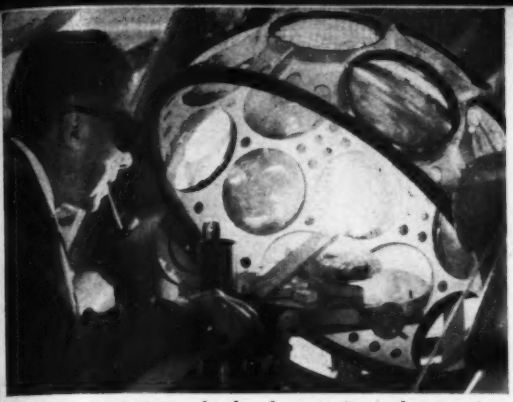
THIS model, shown by Lt. Gen. J. M. Gavin, Army research chief, is the first made public of the atomic-armed Redstone rocket. Reported to be 60 feet long and to have a 300-mile range, it's a step toward a 1,500-mile guided missile.

Big Burning Glass Aids Air Force

TO LEARN how metals behave at ultra-high temperatures, and thus aid work on guided missiles, scientists have swung into action a goggle-eyed machine of glass and metal atop the California Institute of Technology's astrophysics building. This solar furnace, the biggest burning glass in the U. S., focuses the

Burning-glass furnace, balanced by counterweight, turns on its mount to follow the sun.

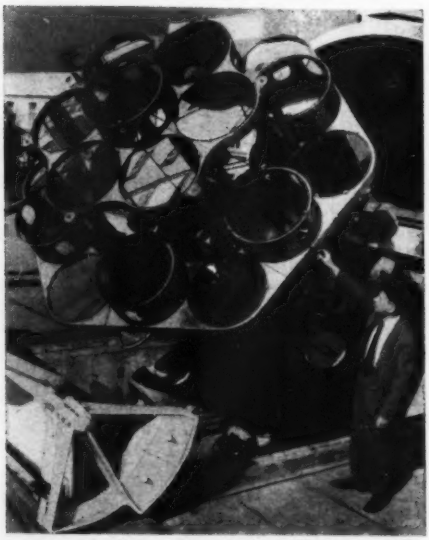




HOT SPOT of solar furnace instantly vaporizes wooden one-by-two thrust into it by Dr. Pol Duwez. Seven-inch lenses in the dome bring the sun's rays to final focus at its center.

sun's rays to form a 5,600-degree F. "hot spot," where a block of wood vaporizes instantly. A piece of firebrick or flue lining, previously doused with water, sizzles and turns to green glass.

A parabolic mirror usually is used in solar furnaces, but this one has lenses to concentrate the rays. Built in 1932 by Dr. George Ellery Hale, Mt. Wilson astronomer, it now is being operated under Air Force contract by Dr. Pol Duwez of Caltech and Dr. Eugene Loh of Stanford Research Institute.



Photos by Ben Olender of Pasadena Star-News

RAYS OF SUN pass through 19 two-foot lenses, above. Then flat mirror disks direct them into smaller lenses shown in the top picture.

Rail Flaws Hunted by Ear

CARRYING electronic listening equipment in a knapsack, this trackwalker tests rail joints, switches and crossings for hidden defects that show up in off-pitch tones. The Erie Railroad uses these hand instruments on vital parts of its New York-Chicago rails to supplement annual inspection by car.

Plastic Car Makes Big Splash

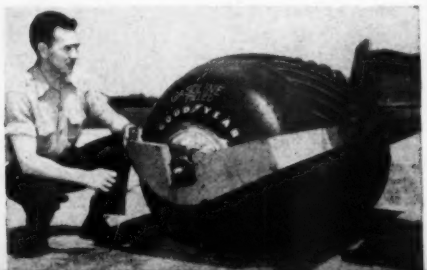
EAST GERMANY's new plastic-bodied P70 is shown above getting a muddy bath. The four-seater is powered by a 22-hp. two-cylinder engine, with a top speed of 56 m.p.h. The Duroplast body is said to be light and flexible.

Rare New Yarn Spun from Wool Of Arctic Dogs

SHAGGY dogs, instead of sheep, provide the wool that Miss Dorothy Luke of Winscombe, Somerset, England, makes into fluffy garments like the one she is wearing. When her three champion Arctic Samoyeds shed (once every nine months), she collects the combings, washes the long hairs and spins them into yarn. Then she knits or weaves jumpers, jackets, scarves, even blankets, that she claims are warmer and longer wearing than ones made of ordinary wool.

Fuel Tank Rolls Like a Tire

THE watermelon-shaped "tire" below is a 250-gallon container for hauling and storing fuels or other liquids. The Rolli-Tanker, developed by Goodyear, can be pulled over land, floated on water, or dropped without danger of bursting.



Birds Become Fish Watchers

AN INVERTED glass dome immersed in an aquarium at a recent London exhibit gave the canaries at left their novel point of view. On the other hand, it also gave the fish a chance at bird watching.

Basketball Hoop is Adjustable

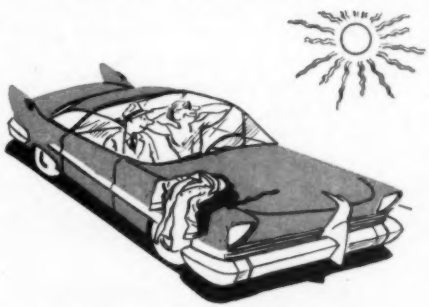
SHORTIES now can enjoy this sport as much as their string-bean brothers at Midland, Mich., public schools. A hand-cranked device allows the basket to be lowered or raised to the desired height.

What's Coming in 1957 Cars

There'll be major style changes. Wheels will be smaller, tires bigger, bodies lower, horsepowers higher. And the big push for safety is still on.

ASK a Detroit chief engineer about his '57 car before the details are "frozen" and about all that he'll admit to is that it has wheels, an engine, and virtues beyond belief. But if you keep asking, especially what he knows about his competitors, you'll emerge with some definite information about the 1957 auto crop:

- It'll be a big year for changes. Unlike 1956, face-lifts will be rare—probably just Lincoln and Rambler.
- Lowness will be the big styling pitch. Present hardtops will look gawky alongside many '57 jobs. Look for some reductions in roof heights of three to five inches.
- Smaller wheels and new tires will be used. Virtually all makers plan to go from 15-inch to 14-inch wheels. Wheel flanges will be farther apart, giving a broader base for the tire and better cornering. The new tires will run at about 22 pounds' pressure.
- Fuel injection is being polished up by several makers, including Packard and Ford. The cost problem remains difficult; at present it is most likely that injection will bow as an extra-price option on limited-production prestige jobs, not on run-of-the-plant cars.
- Suspensions will be extensively revised on new chassis for better ride and handling. Several engineering departments admit that they are running "crash programs" on air-bellows and torsion-bar suspensions; none is certain that they will be ready in time for Car 1 in '57.
- Engines will have more horsepower (surprise!) but this will be achieved more by increases in displacement and compression than by radical change. Both Cadillac and Packard may go to 11:1 compression. American Motors expects to jump the gun with its own economy V-8 in a few weeks.
- Some "two-speed" automatic transmissions will give way to new ones calculated to be more competitive with the three- and four-speed ones. Incidentally, several makers are working on the idea of physically separating the transmission from the engine, as part of an independent rear-wheel suspension system. Development is reportedly not far enough along to make 1957.
- Windshields having already been wrapped to the limit at the sides, are going to begin wrapping *upward*, over the



top. Expect them to creep upward and backward about 2 or 3 inches in '57. Baldheaded guys may scorch their pates but the new glass will give a feeling of "airiness."

- Gadgets intended to loosen up pocketbooks include transistor radios; new gasoline-fired heaters; magnetic-recording machines to keep you company on

long drives; electric door and trunk latches; that long-predicted metal-top Ford convertible; and recessed exterior door handles.

• Biggest technical development on the horizon is the first appearance of centralized auxiliary power systems, to handle the load of numerous power assists and accessories. Olds is reportedly polishing up a hydraulic pressure accumulator; Lincoln and Mercury are working on vacuum systems.

More details on some of the foregoing:

Height shrinking. Very little of the new lowness comes from the smaller wheels: their theoretical rolling radius is only half an inch less, and part of that is taken back by the new tires. Instead, most of the lowering comes from other sources:

1. On new frames, the box members are reshaped to be wider and flatter;

2. Drive-shaft tunnels hug the shaft more closely because of increased attention to something called "carrier nose control"—changes in rear suspension so that the front of the differential carrier won't tilt up so high on a bump; and

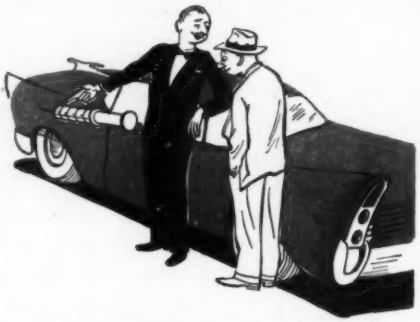
3. Abandonment of the old dream of "chair-height" seats. On the 1957 cars the altitude difference between your seat and your feet will be slightly less.

Once inside the new cars, you'll have about the same headroom as at present.

Getting in or out will take more hunching. One promising sign: back-seat riders in '57 will have more knee room.

The new wheels, for reasons listed above, will make only a slight difference in the effective ratio between drive-shaft turns and car travel—about four or five percent. Thus rear-axle ratios won't *have* to be modified. But the wheel-change effect is in the wrong direction, however, according to the present fashion of pairing big engines with numerically low axle ratios. Accordingly, many of the new cars may have back gears that come closer to (or even below, like Packard) a 3:1 ratio.

Fuel injection. With engineering departments working hard on this, there is much backstage discussion of the merits of the three systems that are chief



contenders (timed injection, continuous injection, and injection carburetors). High costs rule out direct, into-the-cylinder systems.

The advantages are impressive—more output, better economy, and fewer headaches with icing, vapor lock, and half-warm starts. There's evidence, however, that injection may not replace all carburetors for some time yet. To explain this, engineers list two main reasons:

1. The cost of even a cheaper system stays stubbornly above that of *two* four-barrel carburetors; and

2. There is still a few years of "growing room" in existing methods of achieving similar output and economy. Boosting compression and adding displacement will still provide equivalent gains.

"We can give them fuel injection next year, if management wants it," said one chief engineer. "But I hope we're not forced into it for another year."

Centralized auxiliary power. This is an idea that has been predicted by Detroit seers for a long time. Why have one oil pump for power steering, one vacuum servo for power braking, a couple of internal oil pumps in the transmission, and a whole slew of separate electric motors for seat adjustment, windshield wiping, window lifting, and antenna erecting? Why not have a central power source *and reservoir,* with inexpensive servos spotted about to do the chores?

A few unenthusiastic critics of the systems now in development have asked biliously what's wrong with a storage battery as an auxiliary power reservoir. The answer is twofold. The new systems are being created in part to take some of the load from hard-worked electrical systems. And there are inconvenient cost and torque limitations on electric motors on some types of duty.

Vacuum or oil pressure? This promises to be a battleground, for there are cogent arguments each way. Being virtually incompressible, oil pressure can be stored only in aircraft-type hydraulic accumulators. (These are high-pressure containers with an inert gas stored in a bag inside; the oil doesn't compress but the gas does.) Oil under high pressure is smooth, quiet, precisely controllable, and very powerful. The main difficulty: almost everything in such a system has to be manufactured to close tolerances, so costs are high.

Vacuum power seems cheaper – the parts aren't as exacting, and there is already a source of vacuum in the intake manifold. At the same time there are drawbacks:

1. It would probably not be practical to eliminate a mechanical vacuum pump entirely. Moreover, bleeding too much vacuum off the manifold, from the wrong place, roughens engine performance.

2. Vacuum power, being not as compactly muscular as hydraulic pressure, would take more space and more linkage mechanisms. It would also be unsuited for existing power-steering units, now highly developed.

In summary, centralized auxiliary systems are almost certainly due to bow in 1957. What *kind* will ultimately prevail may not be evident for some years yet.

Day of the transistor. This wonder-working gadget promises a lot for auto radios. A completely "transistorized" receiver will last very nearly the life of the car; will take up much less space in the instrument panel; and will draw only trivial current from the battery. Tube radios can discharge a battery in a few hours of engine-off playing; transistor radios can run for *three or four days and nights* before draining the battery. They'll sound better, too: there will be no hum from a vibrator power supply.

The big drawback is cost. Fully "transistorized" radios will be very expensive in 1957. For price-sensitive markets there will be compromise circuits, using both vacuum tubes and transistors. Improved

[*Continued on page 302*]

Douglas C-133A is more than 152 feet long from bulbous nose to tip of its upswept tail.

Fast New Workhorse Joins

THE Air Force's ability to pick 'em up and set 'em down hundreds of miles away in a hurry—guns, troops, jeeps, ammunition, spare engines, or whatever a military crisis demands—got a big boost recently when a giant new turboprop cargo plane, the C-133A, rolled off the Douglas production line.

Capable of hauling twice the payload of its fat-bellied predecessor, the C-124—previously the largest cargo-carrying plane in operation—the C-133A at the same time has slimmer, cleaner lines than that earlier aerial workhorse. Its lean look is deceptive, for the new plane's gross weight is 255,000 pounds, compared to the C-124's 185,000. The C-133A is also considerably faster than the C-124, whose

TUNNEL-LIKE CABIN, 90 feet long, is more than 16 feet in diameter and big enough to accommodate nearly every type of military vehicle. In view below, you are looking toward the tail.

Wing span of the new transport is 180 feet.

the Air Force

top speed was 319 m.p.h., and has a higher service ceiling, estimated to be between 25,000 and 30,000 feet.

In a single load, the giant plane can carry more than 200 troops, or 16 loaded jeeps, or 20 jet engines, or many combinations of vehicles and heavy ordnance. It is independent of ground-starting equipment in any climate.

A 40,000-POUND PRIME MOVER backs into the cavernous body of the C-133A. The giant cargo plane is capable of transporting two of these, or many other combinations of vital freight.

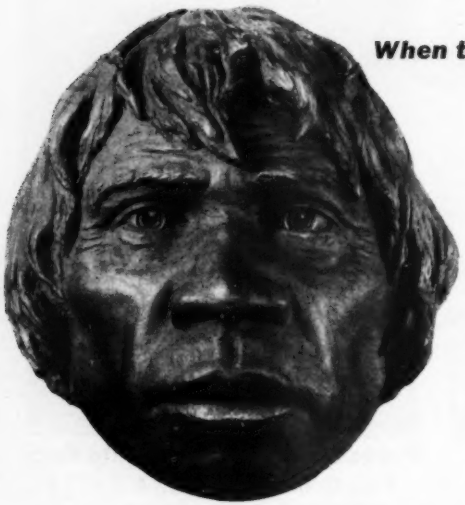
Portable Pillbox to Shield Cop

THIS Detroit policeman is trying on a mock-up for a coat of armor to be worn when shooting it out with barricaded gunmen. In steel plate, the portable pillbox will weigh 65 lb. It has a spotlight on top, bulletproof glass visor, pistol port at hip height.

Motorized Mole Downs Trees

AN OUTSIZE mask of 2½-inch pipe protects the driver of this tractor from falling timber when he lowers the saw-toothed nose and rams through underbrush. Motorized by a 200-hp. International diesel crawler, the rig is clearing land for a Georgia reservoir.

How They Exposed the



When the riddle of Dawson's Dawn Man led a scientist to play detective,

PILTDOWN MAN was visualized as above, before he turned out to be a brazen fake, in American Museum of Natural History restoration. The museum's famed paleontologist, the late Prof. Henry Fairfield Osborn, long was a skeptic but finally joined Piltdown's supporters after examining the finds. Now museum's Piltdown Man exhibit has vanished, won't be back.

PICNICKERS SWARMED over Piltdown diggings (between farm road and hedge at far left) during a Geologists' Association excursion there in 1913. Site is viewed from farmhouse side.

By Alden P. Armagnac

FOR more than 40 years Piltdown Man was a member in more or less good standing of the society of "earliest humans," rubbing mandibles with such distinguished, if lowbrow, company as Peking Man, Heidelberg Man and Neanderthal Man. The startling discovery that he was an out-and-out humbug abruptly terminated his membership, in December 1953. But only now has the whole story of the fantastic hoax been told.

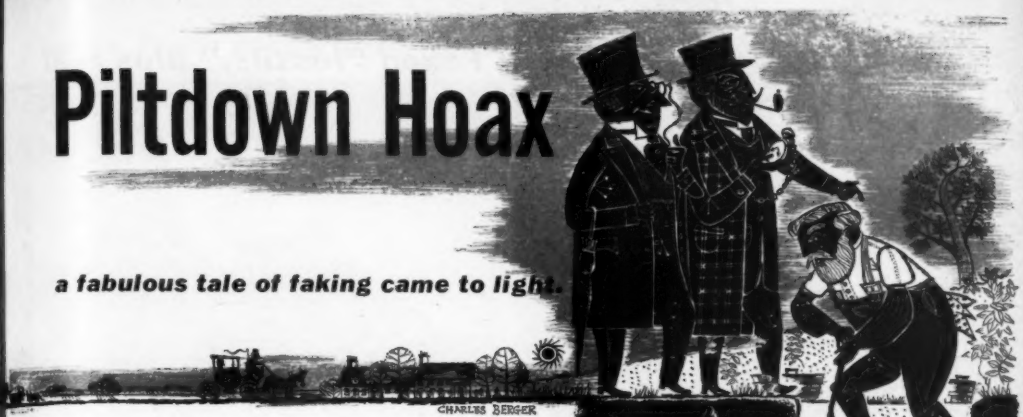
Principally responsible for unmasking it is Dr. J. S. Weiner, Oxford University anthropologist. In the British Museum's latest bulletin on the Piltdown exposures, last year, Weiner promised more details in a book to come. His promise has been kept with the publication by Oxford University Press of his true detective story, *The Piltdown Forgery*—a fascinating 214-page, real-life "whodunit."

An amateur fossil hunter, Charles Dawson, brought the first of the Piltdown finds to the British Museum. He said he'd found them in a gravel pit near Piltdown Common, Sussex, in southern England. Dr. Arthur Smith Woodward, eminent paleontologist of the British Museum, took part in later diggings at the site. All told, the finds consisted of more than 20 remarkable brown fragments of bones, teeth and flint.

Outstanding among these was a truly amazing piece of jaw, whose original

Piltdown Hoax

a fabulous tale of faking came to light.



possessor appeared to be a "missing link" in human evolution. Plainly it was the jaw of an ape in all but one sensational respect, the flat surfaces of two intact molar teeth. Only a human jaw, with its free-swinging motion, could have worn them down to that flat-top shape.

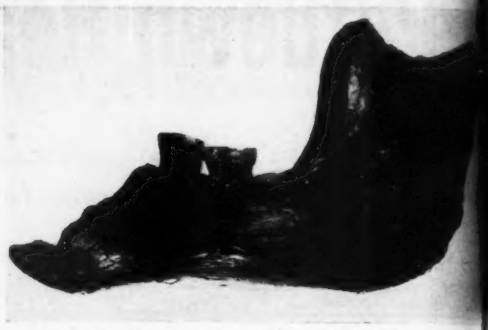
Fragments of the brain case of a prehistoric man's skull, found nearby, seemingly identified the owner. Putting the pieces together—with considerable modeling to fill great gaps—yielded the reconstructed Piltdown Man who was to become famous, with his incongruously high forehead and simian jaw.

The remains of prehistoric animals from the same iron-stained gravel placed the time of Piltdown Man's existence in the Early Ice Age, half a million years ago. In honor of the amateur discoverer, Woodward gave Piltdown the scientific name *Eoanthropus dawsoni*—Dawson's Dawn Man. The rest of the name was appropriate because, at that time, Pilt-

FAKE TOOK SHAPE as "planted" pieces (top view), found and fitted together, yielded the reconstructed skull above. Missing parts were filled in. In book on the finds that A. S. Woodward later wrote, *The Earliest Englishman*, he pictured "Piltdown Man" as at left. An innocent victim of the hoax, he vainly continued digging in the pit for years.

SEEKING FOSSILS, Charles Dawson (left) and Woodward screen and wash gravel from pit where hired man is standing, in 1912 photo at the Piltdown site. House is behind distant trees.

Faked "fossils," plus real



FAMOUS PILTDOWN JAW was thought "missing link's" because of flat "human" teeth, now known to have been deliberately filed. Jaw actually is a modern ape's, stained to look old.

down was believed to be the earliest known human.

For decades his rebuilt skull was a storm center of controversy. Many agreed from the first that cranium and jaw belonged together, and subsequent finds convinced others of it; but there were heated opposite views.

Piltdown began to hit the skids in 1950 when a chemical dating test convinced Dr. Kenneth Oakley, British Museum geologist, that the remains were only 50,000 years old instead of a half-million. The longer bones lie buried, the more fluorine they absorb from ground water; and so the relative age of fossils from the same site can be told by their fluorine content. Oakley used this fact. What he didn't know was that his tests were invalidated by his innocently—and mistakenly—assuming that all the fragments had genuinely originated at the Piltdown site. By accident his estimate happened to be right, for the age of the cranial fragments. (He was wrong in calling the jaw as old.)

By deposing Piltdown Man from the "earliest" group, Oakley's widely accepted redating made him more of a riddle than ever. A half-million-year-old missing link had been conceivable. A missing link as recent as the Magdalenian men who produced Europe's finest cave paintings was an utterly incredible throwback. Embarrassed experts wished Piltdown would go away.

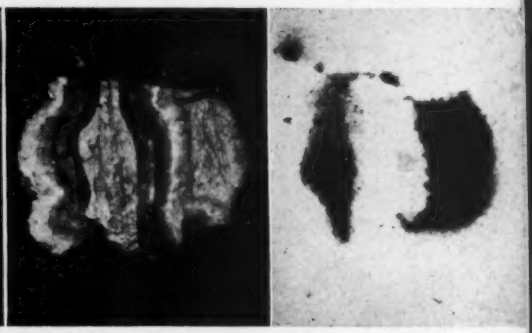
So went the table talk, one summer evening in 1953, when Weiner dined with Oakley in London. Home in Oxford that night, in the small hours, Weiner once more revolved in his mind everything that made Piltdown such an impossible misfit. Above all, those "human" teeth in an apish jaw, worn as flat as by a file . . . A thought struck him like a blow: *Could* they have been deliberately filed flat? He recalled Sherlock Holmes' words: "When you have eliminated the impossible, whatever remains, *however improbable,* must be the truth."

With a colleague, Prof. W. E. Le Gros Clark, Weiner next day checked Oxford's plaster copy of the Piltdown skull, which heightened his suspicion. He secured a chimpanzee's molar tooth, filed and stained it, and had a good likeness of a Piltdown molar. Next stop was the British Museum, where Weiner and Clark enlisted Oakley's aid.

Out of a locked, fireproof steel safe came the hallowed Piltdown fragments for the most searching anatomical, chemical and physical examination they had ever received. Instruments as modern as X-ray spectrograph and Geiger counter came into play. An accurate, improved chemical dating test measured the bones' loss of nitrogen with passing time.

ones from elsewhere planted at site, built up hoax

"OLDEST TOOL," right, was believed carved by Piltdown Man from fossil-elephant bone with a flint knife. Trials proved it impossible. Making a duplicate (left) required a steel knife.



HIGH RADIOACTIVITY of fossil-elephant tooth, shown by radioautograph (right), contradicts claim it came from Piltdown pit. Likeliest source: Tunisia, where similar specimens occur.

Telltale scratches on the molars, and on a separate canine tooth, showed beyond doubt that the teeth had been artificially filed. And they were unnaturally sharp-edged, just as a file would leave them. Lost in the plaster casts studied the world over, these details were clear in the original specimens.

For the chemical tests the museum authorized far more generous samples than Oakley had been permitted to take, in 1950, by gingerly applying a dental drill to worn or broken surfaces. When Oakley now drilled the jaw, he noticed an acrid smell of burning horn and obtained tiny shavings, as with fresh bone.

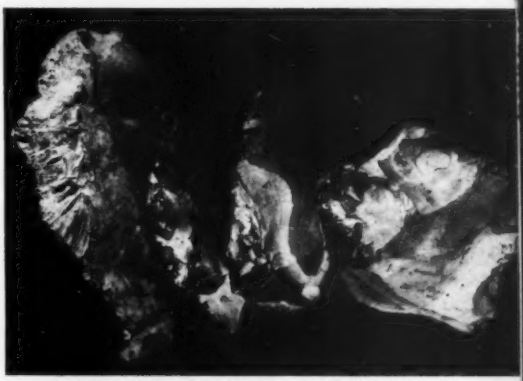
The jaw turned out to be from an ape, and a modern one at that—probably an orangutan. Cunningly the faker had "fossilized" it by staining it a mahogany color, with an iron salt and bichromate. The puzzle was solved of how the jaw could be an ape's—as some Piltdown skeptics had always insisted that it was—despite the fact that there were no apes in England in the Ice Age.

The separate canine tooth's dark-brown coating, always thought a natural iron stain, turned out to have the composition of Vandyke brown paint. An oil paint, probably red sienna, stained the chewing surfaces of all the teeth.

At this stage, when the three investigators reported in 1953 that jaw and teeth were bogus, they pictured the hoax as a fairly simple one. Seemingly the diggers, all innocent victims, combined with genuine relics a skillfully faked jaw and canine tooth that some prankster had planted in their diggings.

So when the three later came to testing the cranial pieces, and other Piltdown trophies, they were astounded by what they found. Every important piece proved a forgery. Piltdown Man was a fraud from start to finish!

[*Continued on page 272*]

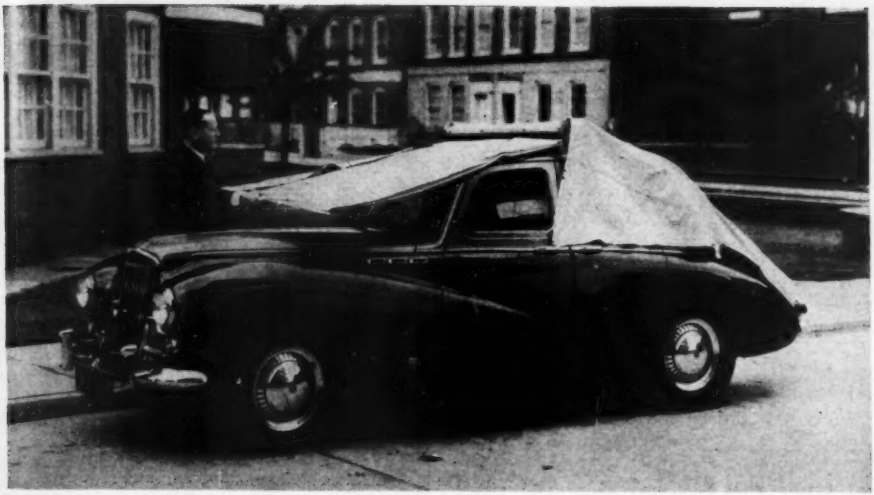


"PILTDOWN" FLINT TOOLS at British Museum include new-found Morris flint, far right, still bearing former owner's inscription accusing Dawson of fraudulently staining it. Photos of picnic, skull, jaw, "tool," tooth and flints are from new book *The Piltdown Forgery*, by J. S. Weiner, published by Oxford University Press.

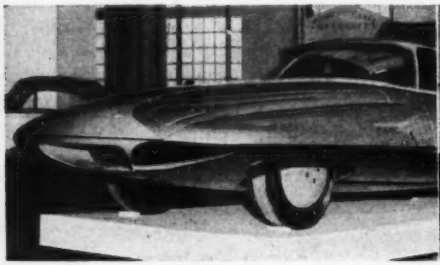
Auto News from Europe

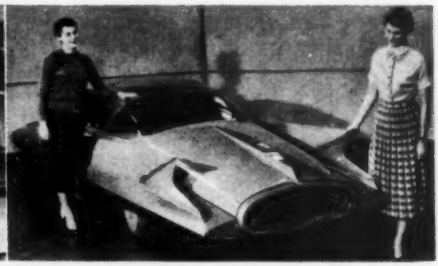
Roomier than it looks, this new Italian Fiat 600, posed against a background of Rome's ancient Colosseum, seats six passengers. Fold down the back seats and it can be used as a utility truck. The car has four speeds, hydraulic brakes on all four wheels, and a four-cylinder power plant that is located in the rear.

Hill-climbing ability of the little two-cylinder, 17-hp. car at right has been shown in Alpine rallies and reliability trials. Known as the Goggomobil and made in Dingolfing, Bavaria, it accommodates two adults and two children (as in the phantom view at far right). It has an all-steel body, a rear-mounted engine and a front luggage compartment. Center photo shows how the two-stroke, fan-cooled engine is constructed as a unit with the gearbox and differential.

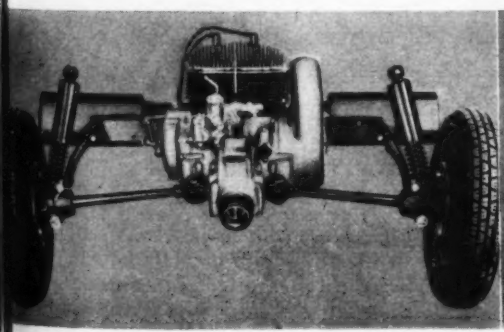


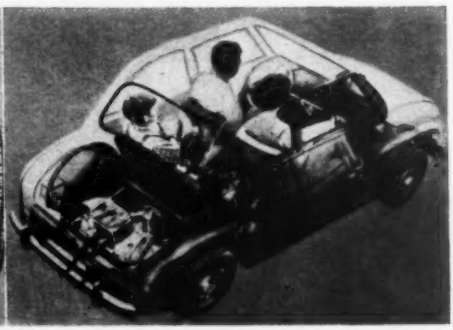
A garage wherever he goes is provided by the lightweight canvas this gentleman is unrolling. It's a British car umbrella to protect the vehicle from the elements. When not in use, the Carbrella rolls up into a neat package that is held to the top of the car (like a luggage rack) by metal clamps and suction cups.





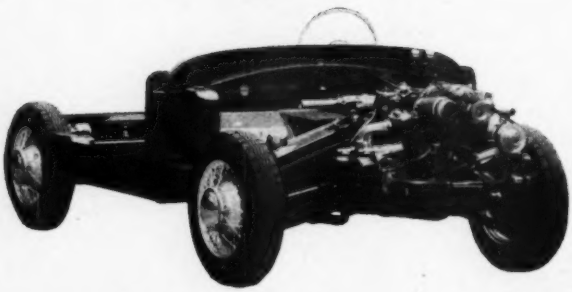
Star of the auto show at Turin, Italy, the Ghia Gilda (front view, above left) is a superstreamlined car of tomorrow. Its long, low body ends in two sweeping tails (above right). The engine, to be mounted in the rear, may be a gas turbine. Wind-tunnel tests indicate that it might hit a speed of 225 miles an hour.





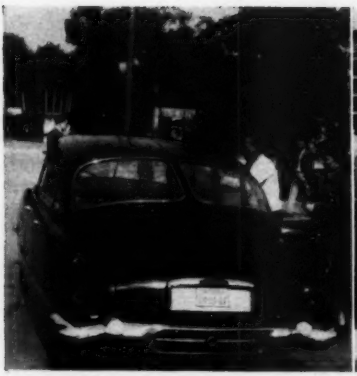
Please turn the page for more auto news from Europe

French Sports Car Is Fast, Smooth



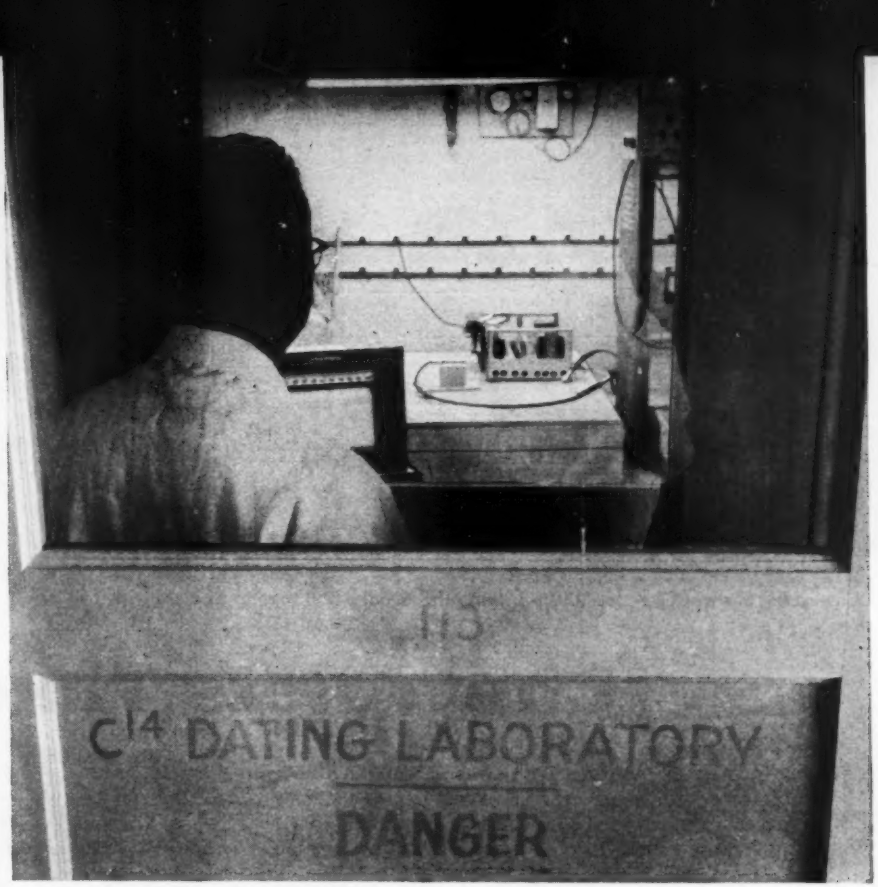
IN MANY sports cars speed and road holding are gained at the sacrifice of comfort. To overcome this, J.A. Gregoire, French automobile designer, developed a suspension in which the rate of springing varies automatically with the load of his 135-hp. two-seater.

Road holding, too, is increased by placing most of the 2,200-pound weight on the front axle. A four-cylinder, flat engine (shown at left) can deliver a top speed of 125 miles an hour.



Rear-Engine Czech Car Has Wrap-Around Windows

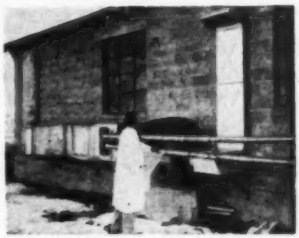
THE wrap-around rear window in the Tatra T 603 is made possible by placing the eight-cylinder, air-cooled rear engine low in the frame. A roomy six-seater, made in Czechoslovakia, the car is said to have a speed of more than 100 m.p.h. The lid of the forward trunk has an air duct for interior ventilation.

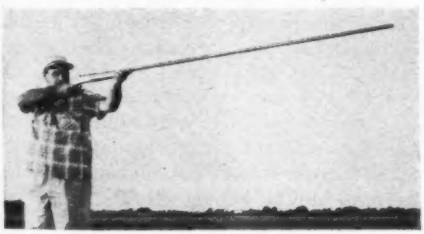


Fallout-Proof Lab Keeps Atomic Clock on Time

A SEALED room, fed with air that has been filtered five times and washed, keeps A-bomb dust out of the machinery which dates ancient relics by measuring the radioactivity of their carbon content. A speck of additional radioactivity from bomb-test fallout would throw off completely the carbon-14 dating process.

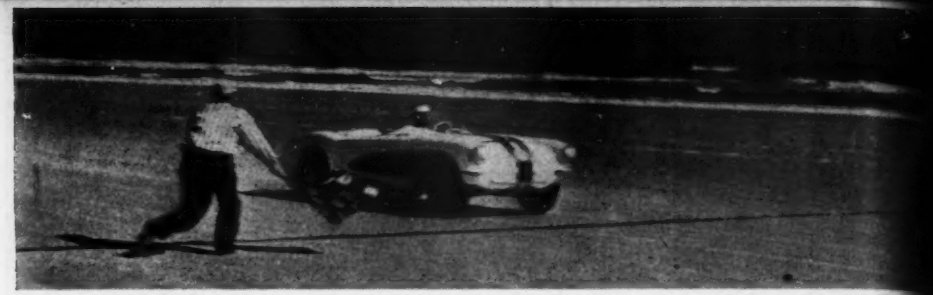
A special air conditioner (right) supplies the University of Colorado lab with super-clean air, which may be 40,000 times less radioactive than outside air.





Long Gun Aims at High Squirrels

A SQUIRREL couldn't find a tree tall enough to get out of range of this gun. Julius Petty of Stuttgart, Ark., national clay-target champion in 1954, believes that the shotgun he is aiming in the photo at left has the longest barrel in the world. It measures six feet 11½ inches.



Corvette, John Fitch driving, averaged 145 to take production sports-car title at Daytona.

Fastest big car was Chrysler 300B—139 m.p.h.

Dodge 500 topped its class with 130 m.p.h.

Chevrolets Take

INVIGORATED by its new V-8 engine after more than a year of eating Thunderbird dust, the Chevrolet Corvette showed a dazzling turn of speed at Daytona Beach, Fla., in the first competitive running of 1956 cars. Corvettes driven by John Fitch and Betty Skelton flashed through the flying-mile time traps at two-way averages of 145 and 137 m.p.h. A non-stock Corvette, with a slightly increased compression ratio and a tail fin hit a theatrical 154 m.p.h. on one run. The best that the Thunderbird could do in the stock sports-car category was third place, with 134-m.p.h. average.

Among the "strictly-stock" passenger cars, one big surprise was in the class having engines of 305 to 350 cubic inch displacement, a group that included Pontiac, Buick, Mercury and Chrysler Windsor. Here a clean win was scored by a Dodge 500 piloted by Danny Eames at 130, six m.p.h. faster than the Merc.

In the big-engine class, the top four places were taken as expected by Chrysler 300B's. The quickest of these was driven by Tim Flock at an average of 139 m.p.h. A Studebaker Golden Hawk managed to take fifth place with a 122-m.p.h. average. The only 1956 Cadillac among the front runners came in ninth with a speed of 113 m.p.h.

In the tensely contested big-three class, Chevrolet took the first two places at 121 and 119 m.p.h. to top Ford's 118.

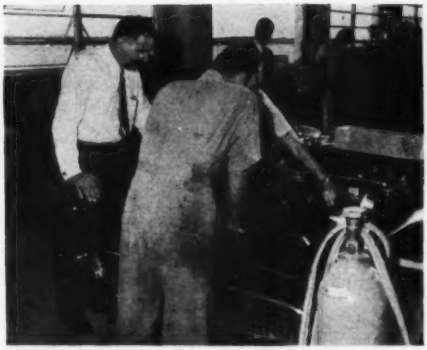
Speeds were even showier among the "prototypes"—cars classified as not strictly stock. A Plymouth Fury was clocked at a blistering 143 m.p.h., and a special Mercury with fuel injection at 152 m.p.h.

On acceleration runs in the big-engine class, two 300B's led a third-place Lincoln, with a Golden Hawk fourth. In the medium-engine group, a Dodge took a Mercury by a few hundredths of a second. Chevvy led Ford in passenger-car acceleration. But two T-birds led Corvette among production sports cars.

Intense Detroit participation was evident at this year's run. At least six manufacturers worked on the preparation of their cars; and both Ford and Chevrolet sent virtual task forces to the beach—racing managers, expert mechanics, and spare parts by the truck load. Although the speeds achieved were obtained within the letter of stock regulations, they bore only a remote relationship to what a man might expect from a 1956 car purchased at random.

Late at night Chevvy crew was busy taking car apart and putting it together again for trials.

'56 Speed Honors



FACTORY CREW, including Ford chief engineer Bill Burnett (left), checks disqualified T-bird.

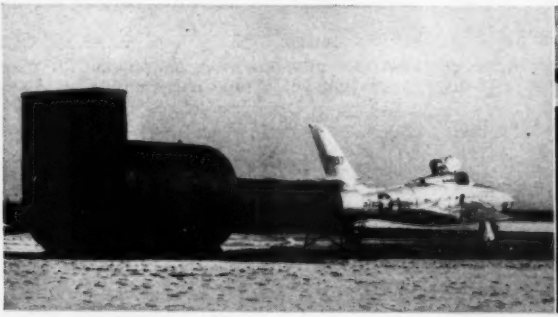
AMATEUR DRIVERS used impromptu facilities outside garage to tune cars for Nascar races.

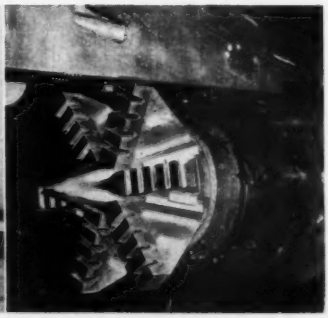
DELEGATIONS of executives, photographers and walkie-talkie operators attended factory entries.

WOMAN DRIVER Betty Skelton wasn't there just for looks. She piloted second-place Corvette.

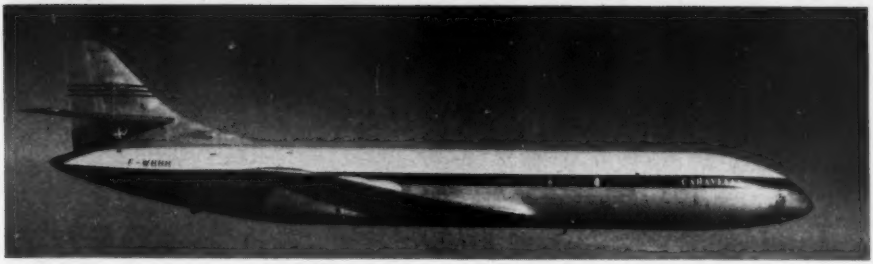
New in Aviation

Copter perch With only inches to spare, this Piasecki H-21 flew in and landed on top of a small platform used for making radio-antenna measurements. Other types of aircraft have to be hoisted up.



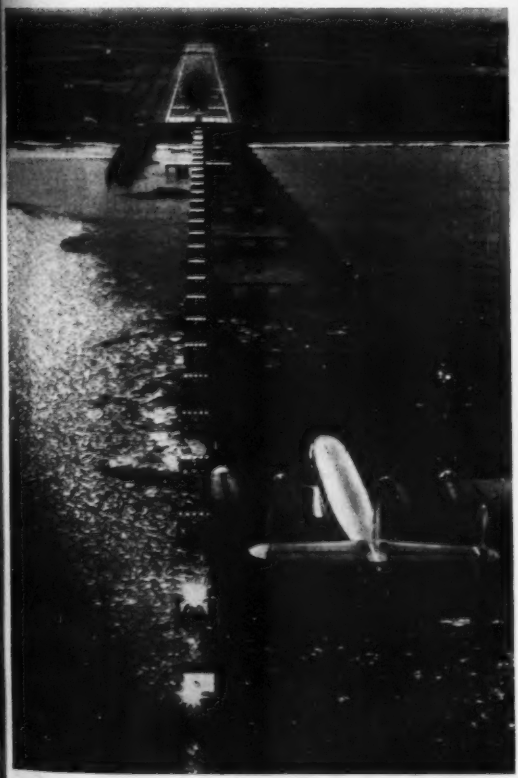


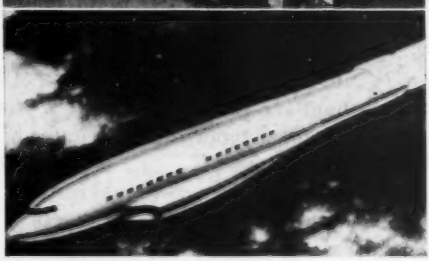
Hush-ups Mufflers for jets must be perfected before passenger versions go into general service. The tank-like contraption at left above is being tested by Republic Aviation to quiet the roar of its Thunderstreaks during ground run-ups. The device at right, developed by Boeing, breaks up the jet-exhaust stream and is said to bring flight noise down to that of a propellered airliner.



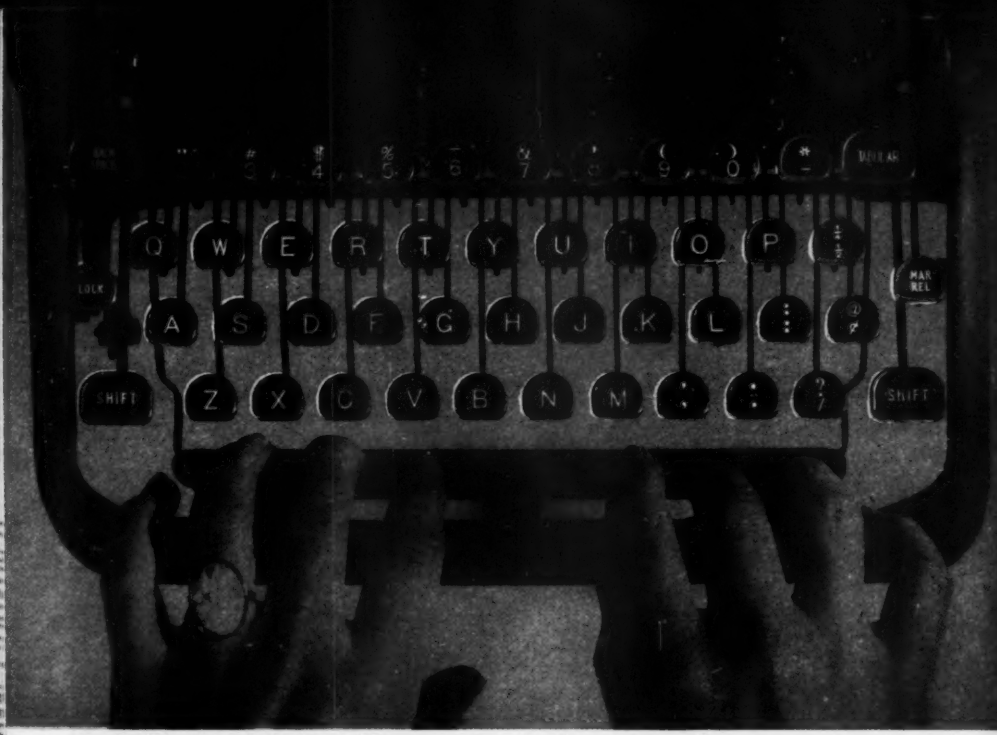
Pushers Twin jet pods of the French Caravelle airliner, now shown in flight, are located on either side of the rear fuselage, behind the wings. The planes, ordered by Air France, will carry 70 passengers at 475 miles per hour.

Landing arrow Flashing lights of 30,000,000 candlepower, which resemble tracer bullets speeding at 2,700 miles an hour towards the centerline of a runway, now guide pilots into N.Y. International Airport when visibility is poor. Each of 20 Sylvania Stratobeacon units flashes twice a second.





Flying cigar The model at top is being remote-controlled by its German-born designer, Dr. A. M. Lippisch, to test a new internal lift-propulsion system that may power a wingless Aerodyne of tomorrow (artist's drawing above). Principle combines a gas turbine with ducted fans for control.



Standard keyboard, designed 83 years ago, makes fingers jump all over to type simple words.

Why They Want to Shift

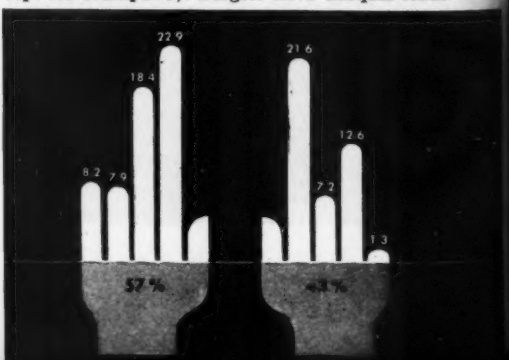
PYFGCRL or QWERTYUIOP? Advocates of the former claim that it speeds typing, cuts errors and fatigue.

ONE day last August Tom Booz of Boston started to learn the hunt-and-peck system on the strange keyboard of a newly designed typewriter. "I laughed," he says now, "when I sat down at the machine."

By December, after no formal instruction, and only odd moments for practice, Booz was typing—not hunt-and-peck—with a fairly rapid eight-finger system. And now Thomas Spencer Booz Jr., a 44-year-old businessman, not only is typing his own letters at a speed rivaling that of a secretary, but also is a super-enthusiastic salesman for the Dvorak simplified keyboard.

This keyboard consists of an arrange-

ON STANDARD, left hand does more work (bad except for southpaws). Fingers have unequal loads.



Dvorak keyboard, scientifically planned, puts 90 percent of typing on one row: AOEUIDHTNS.

the Typewriter Keys

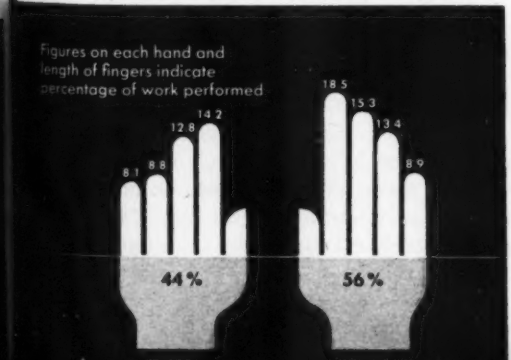
ment of letters entirely different from that on any standard typewriter. It is intended to make typewriting (1) easy to learn, and (2) easy to do.

The new arrangement was worked out, and patented, by August Dvorak, Ph.D., professor of education at the University of Washington, after more than 600 experiments.

Right now, the Federal government, which runs 800,000 typewriters—and therefore could save millions of dollars if they were easier to learn and use—is testing Dvorak's product. The General Services Administration (GSA) is comparing the results of both men and women using the Dvorak keyboard with the results of other typists on standard keyboards. The outcome is expected to be announced next month.

Meantime, Dr. Dvorak and Tom Booz believe that they have the best chance in

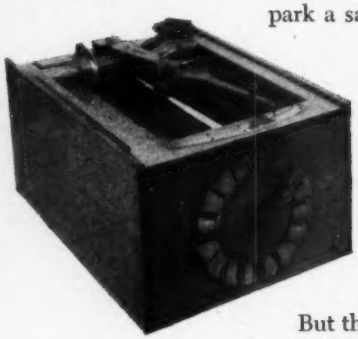
ON DVORAK, right hand works harder; each finger does its share. Result: more speed, less fatigue.



history to change the typewriter keyboard—something that many have tried but no one has succeeded in doing. They launch into a sales talk whenever they find a listener: man, woman or child.

Many keyboards have been tried

Unlike ordinary typewriter salesmen, Tom Booz does not park a sample machine with you for several days' trial. He has none for the purpose. Instead, he tells you that all typewriter companies, for $10 to $25 extra, will provide a Dvorak keyboard on a new machine instead of the old standard.



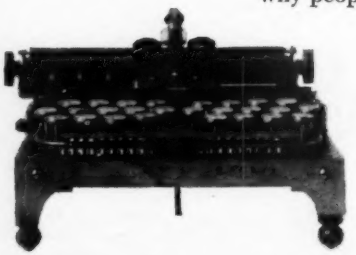
Burt Typographer (1829) had key on top to rotate type into place. Dial showed when paper was full.

The letters on the principal line of the standard keyboard are ASDFGHJKL. On the Dvorak keyboard they are AOEUIDHTNS.

This means that, using letters on only this one line, you can write 3,000 words—instead of the 57 words you can scrounge out of ASDFGHJKL.

But that's only the beginning.

When you get set to type, your eight fingers, resting on this main line (or home row) of letters, are in place on eight of the letters you'll use most. All you have to do to strike any of these common letters is push down the finger resting upon it—not hunt over the keyboard for the letter. That's why people learning the Dvorak keyboard quickly slide into a touch system.



Crandall machine (1881) had 26 keys that turned cylinders, pressed type to paper.

The keyboard also makes typing errors difficult instead of easy. Among the most common mistakes in typing today, Booz explains, are ones like these:

The spelled as *hte.*
Of spelled as *fo.*
And spelled as *nad.*

These commonest errors are all of one kind: The letters as typed by standard machines appear on the paper in the wrong order. This is because all of these words involve, on the standard keyboard, the moving of fingers from one line to the next. On the simplified keyboard, because the most commonly used letters are on one line, such inversions will happen less frequently. "The" and "and," for instance, are on the same line. And even "of" is made easier because "o" is right under a finger and you're more likely to punch it before you reach for the "f."

Dr. Samuel Francis' patented "Literary Piano" (1857) typed with piano keys.

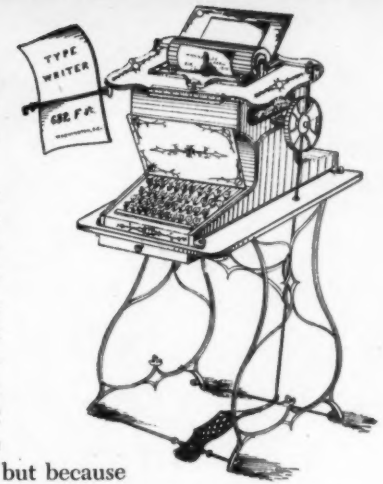
Take something harder. Tom Booz suggests that you type—or try to type—on a standard the phrase "minimum pumpkin." (I just tried to type it myself and made two errors.)

"Minimum pumpkin" (one error this time) is not a phrase that you will commonly use. But it is a phrase that shows clearly how the standard keyboard makes your fingers

jump from the bottom line of letters, right over the middle line, and up to the top line for the next key. This jumping, Booz says, causes lots of the other mistakes in typing.

Besides, on standard machines, he points out, you have to type "minimum pumpkin" (one error again) entirely with your right hand. This, he says, is awful. Because vowels and consonants often alternate in normal English, he explains, a keyboard should have vowels struck by one hand, consonants by the other. The keyboard planned this way, of course, is the Dvorak.

The standard typewriter keyboard was put together in 1873—not because the letters were convenient for typists (there were none then) but because of mechanical difficulties (long since overcome). The history of the typewriter ever since has been a history of reform keyboards. Dozens have been tried. None has been accepted. People—including the nation's 2,500,000 female secretaries—who have learned one system of typing don't want to learn another keyboard.



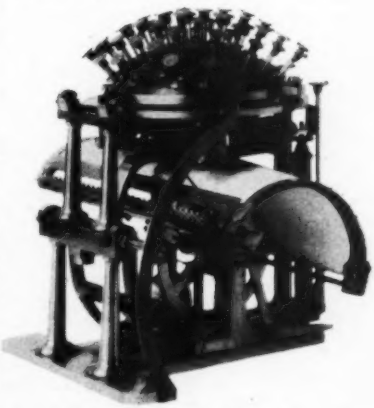
1875 Remington, from Christopher Sholes' design, had today's standard keyboard, launched typewriter boom that has lasted ever since. A foot treadle to return the carriage and stenciled front and side markings were added by a sewing-machine man, William Jenne.

"The big thing that scares all the little girls," Booz says, "is the idea that they have to relearn—they visualize another couple of years. The fact is that they can learn the Dvorak keyboard quickly, whether or not they already know the standard.

"Besides, if a girl knows both keyboards, she can use them interchangeably. You don't have to forget the standard keyboard to know the new one. Not at all. Many people know two keyboards now." Many linotype operators also run typewriters, and many secretaries who run typewriters also take notes on stenotype machines.

Though Booz knows there is resistance, he believes that the simplified keyboard will in the long run reform the nation's secretaries. Polls show, however, that most girls think that the bosses are the ones who need remodeling. (They think that bosses would be more understanding and thoughtful if they knew how to type.)

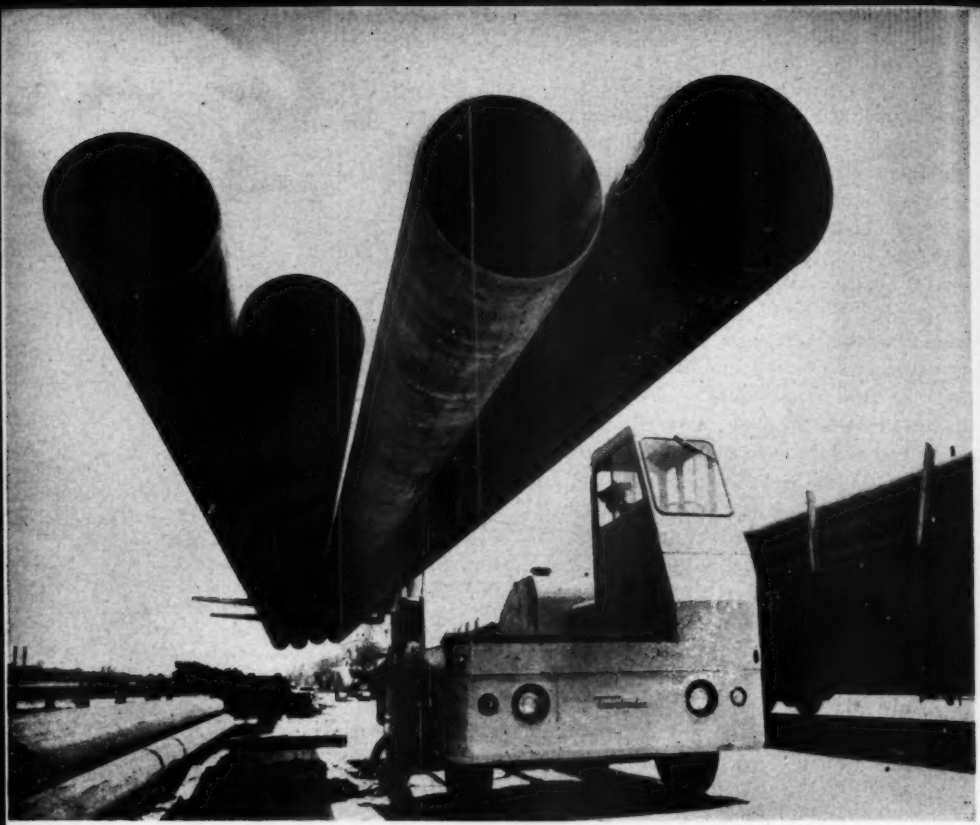
As Booz breezes along with his sales pitch, he tells why, for secretaries, the Dvorak keyboard is ideal:



The Malling-Henson (about 1850) had keys on top. Pressing these down imprinted letters on paper on cylinder beneath them.

Mileage. The fingers of a secretary today, he says, have to hop-skip-and-jump a total distance of 12 to 20 miles a day on the standard keyboard. The Dvorak keyboard, with the commonest letters on that single home row, cuts the same typist's finger travel to about one mile—a reduction of as

[*Continued on page 280*]



Truck with Side Cab Lifts and Carries Long Loads

THIS odd-looking truck not only hauls extra-long loads along ordinary highways at 30 m.p.h., but can load and unload itself. Here it's taking on 40-foot lengths of 30-inch pipe on hydraulic forks controlled from the offset cab. It is built by Baker-Raulang Co. of Cleveland as a lumber, pipe and structural-steel carrier. The arms can hoist a weight of six tons as high as 12 feet from the ground.

They Say Now . . .

DR. JOHN T. RETTALIATA, PRESIDENT, ILLINOIS INSTITUTE OF TECHNOLOGY: *"In the industrial world of the future, brains will be in much greater demand than brawn, and the jobs more rewarding."*

FRANK H. BOWLES, DIRECTOR, COLLEGE ENTRANCE EXAMINATION BOARD: *"There is a direct relationship between expansion of education and expansion of the economy."*

SHERMAN M. FAIRCHILD, CHAIRMAN, FAIRCHILD CAMERA & INSTRUMENT CORP.: *"If we continue the advances in technology at the same rate as we have in the past, no nation will ever again be able to build up secret arsenals or military strength without being detected . . . The eye in the sky—whether it be photographic, electronic or a combination of many sensers—will be virtually all-seeing."*

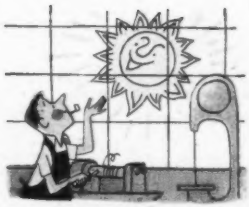
ADMIRAL DEWITT C. RAMSEY, PRESIDENT, AIRCRAFT INDUSTRIES ASSOCIATION: *"To have better combat aircraft we must have more power. To have more power we must have more noise."*

TRUE D. MORSE, UNDERSECRETARY OF AGRICULTURE: *"Great cities . . . look to farms as a source of produce, as a market for industrial goods, and for youth with which to maintain their population."*

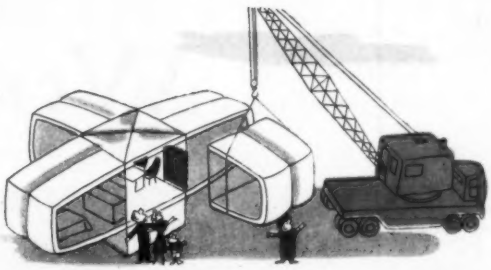
POPULAR SCIENCE Monthly

1956 Home Show

The following 48 pages are devoted to your house—the house you have, the house you could have, the better-yet house that your children may have.

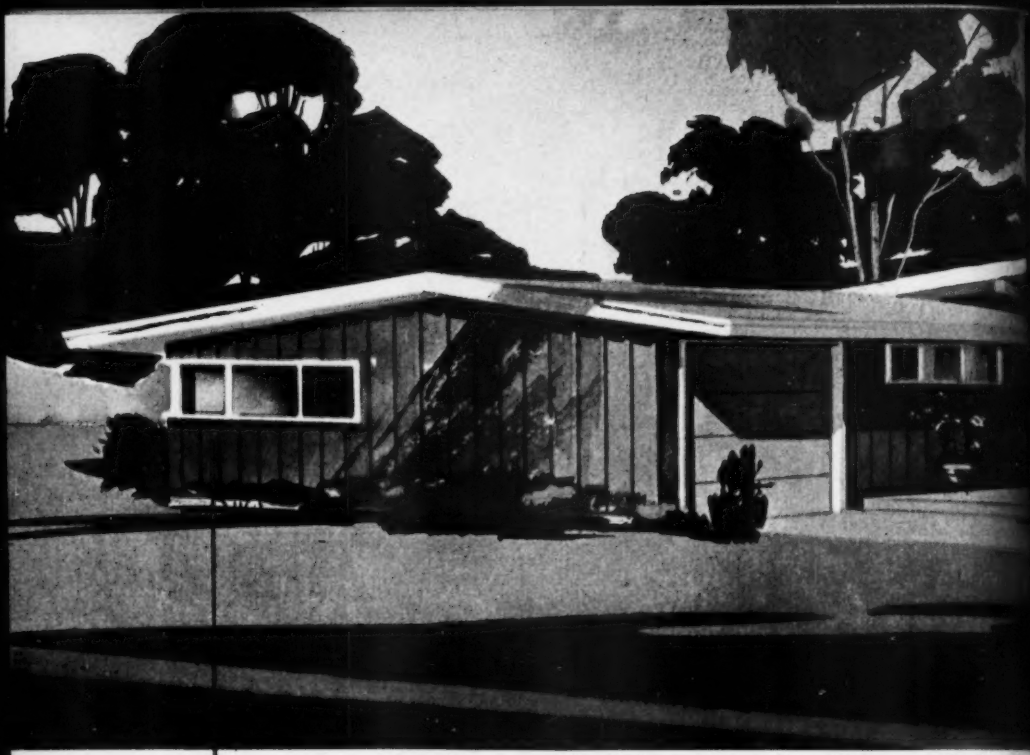


FOR TODAY, here is a house plan designed with you, the handy-man-of-the-house, in mind. It has a workshop, no dark and dreary afterthought, but a bright, airy and spacious room that is organized as carefully for efficiency as the rest of the house is for pleasant living. Actual building plans are available.



FOR TOMORROW: plastics. Scientists forecast unique plastic-shell rooms hanging on a small utility-core foundation. You could even add on or take off plastic room units as your family needs changed.

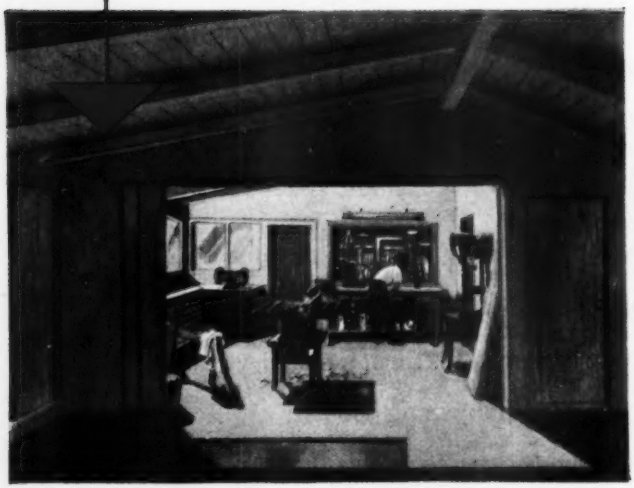
FOR RIGHT NOW, here are 39 pages that show you how to modernize the place you are living in. Even if it is venerable Victorian, a screened terrace, a patio, new appliances or just a wallpapering job can bring it up to 1956. Turn the pages and see.



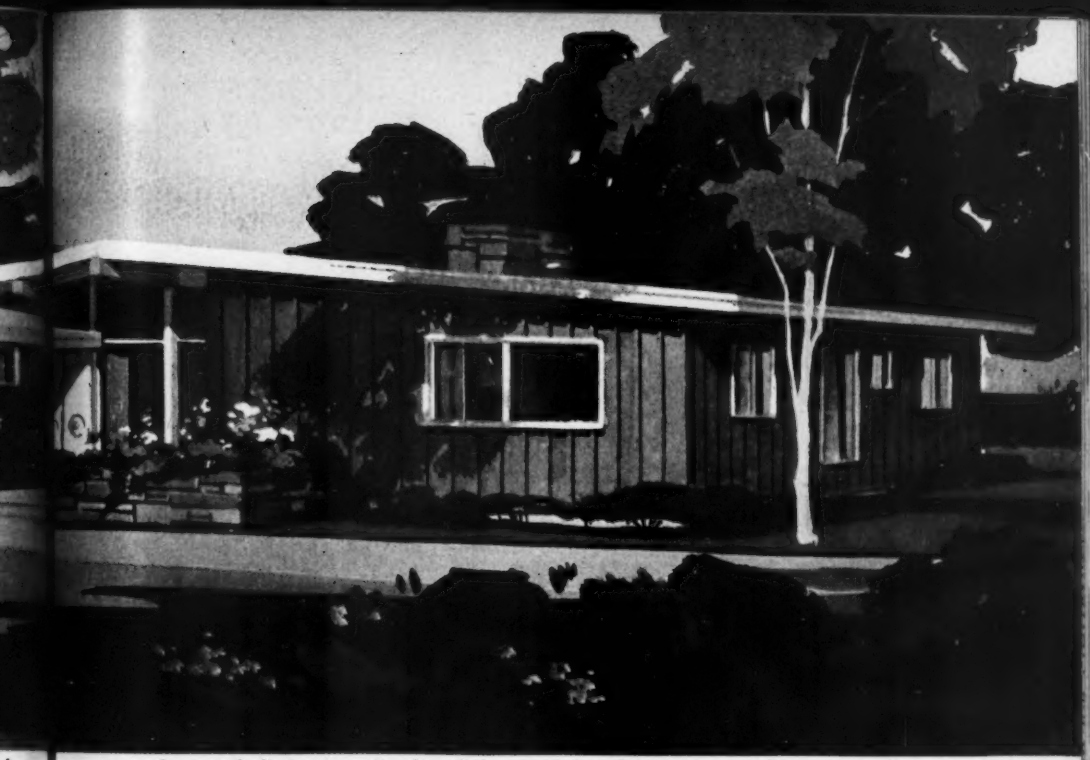
Low lines, a gently sloping roof and big windows mark this

1956 Home Show

Workshop



SLIDING DOORS between the do-it-yourself room and garage disappear into the walls, more than doubling your work space for big projects. With the garage door open in summer, you are practically working outdoors. Corner windows to the left of your PSM workbench provide cross-ventilation and plenty of light. And while you're just a step away from the family during the day, you're the width of the house removed from the bedroom area to dampen sound.



as a home of distinction. Outdoor-living area (porch, terraces, pool) are away from street.

House *gives Dad a do-it-yourself room of the kind that all craftsmen dream about. It's planned as carefully as Mom's kitchen.*

By GARDNER SOULE

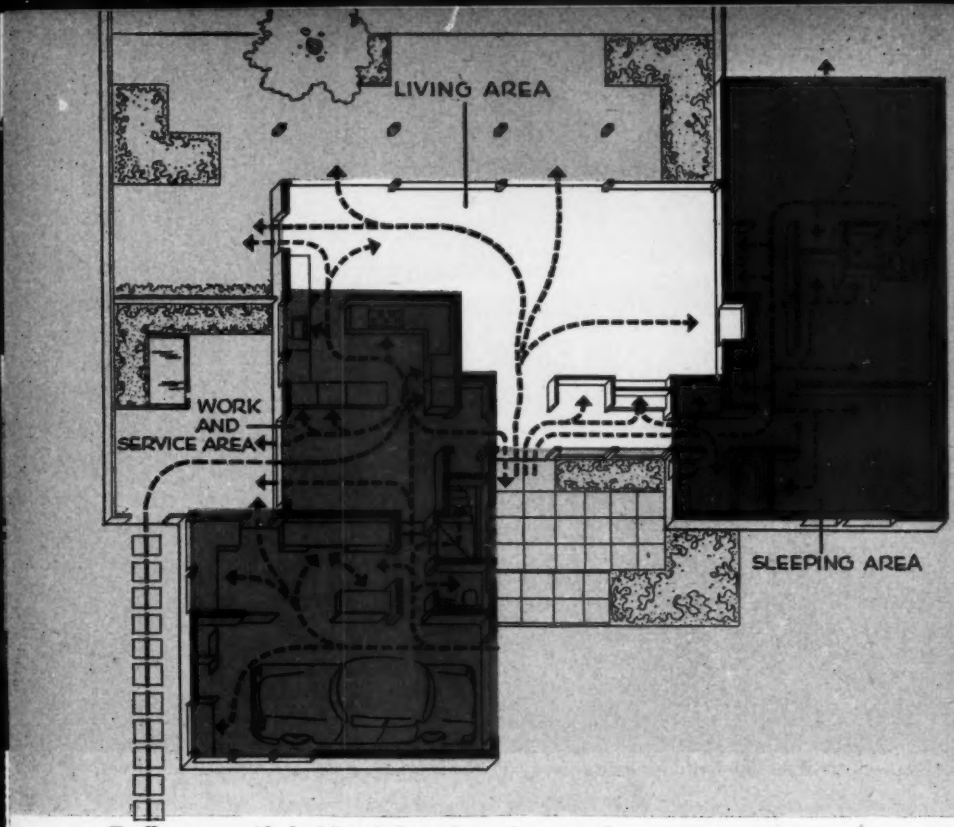
THE modern home needs a do-it-yourself room, a place designed for the handyman. Yet few houses being built now have any sort of workroom.

"It's the greatest unfilled need in American homes today," says Rudolph A. Matern, one of the country's foremost house designers.

To meet this need, POPULAR SCIENCE MONTHLY asked Matern to prepare plans for a house that would be specifically tailored to the handyman's requirements. You see the result on these pages: architect's sketches and blueprints for the PSM Workshop House.

The shop is a vital part of the PSM House, as carefully planned as the mechanized kitchen. It has big windows for light and air. It is close to the living quarters and a washroom. It is efficiently planned for convenient working. And it can borrow space from the adjoining garage to make room for a big job.

Rudy Matern is an expert on home buyers' needs and preferences. Since World War II he has probably helped to house more families than any other architect. In addition to turning out designs



Traffic pattern (dashed lines) shows how plan provides easy movement among house areas.

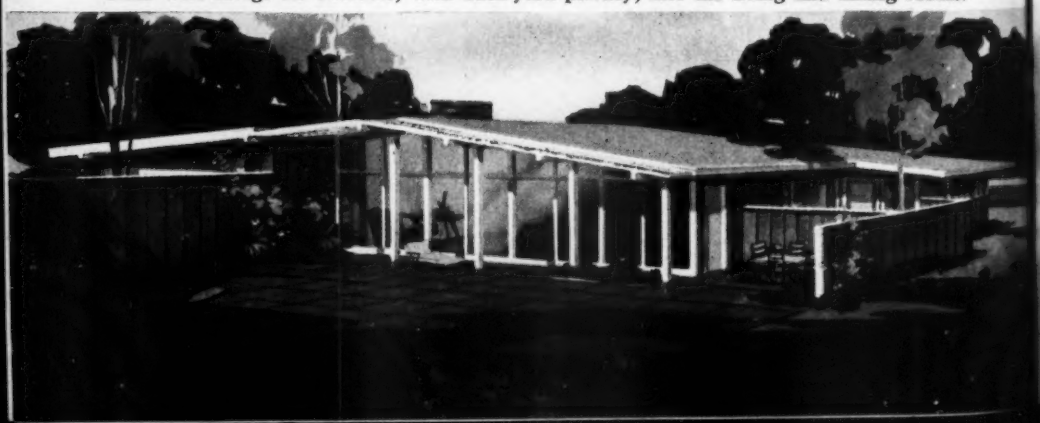
for many new developments, he sells thousands of copies of his plans by mail. He has learned from the ones that sold fastest how Americans want to live. In this, his latest house plan, he has used all of this know-how.

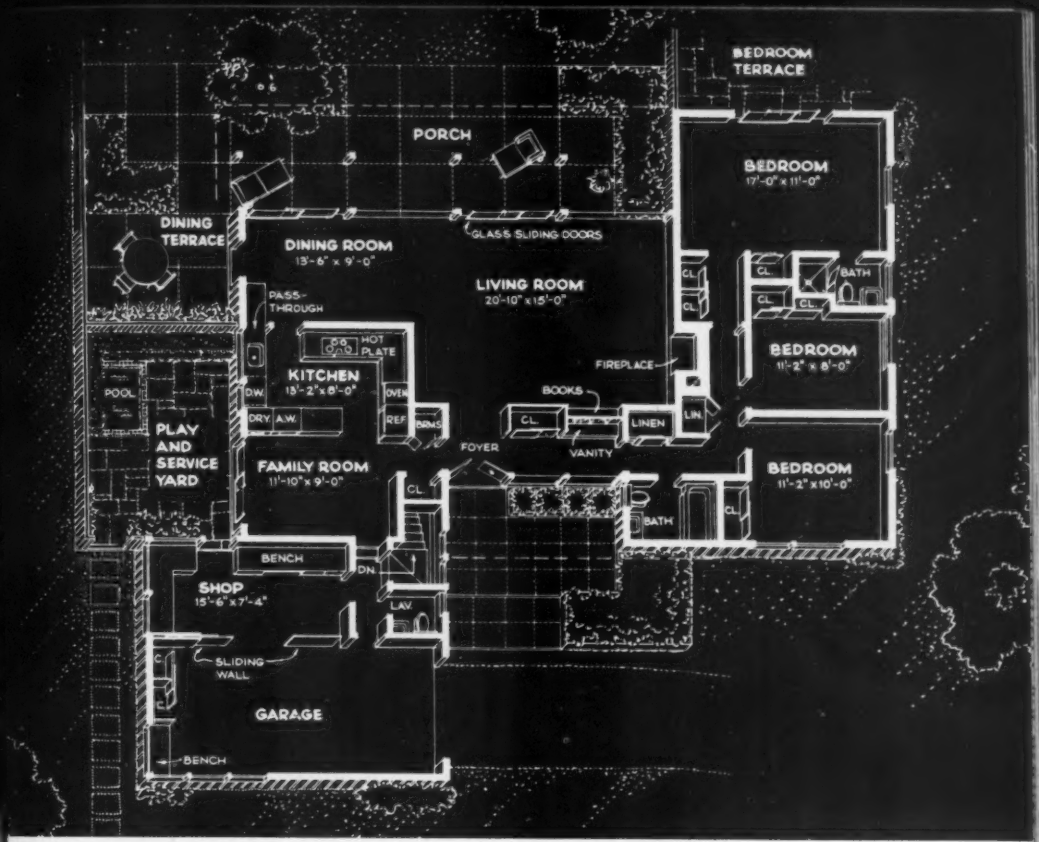
Near the family. This do-it-yourself room is not down in a corner of the basement away from the rest of your family. It is right next to the family room, where Mom and the kids will often be.

"It has," Matern says, "the circulation of air so important when spraying paint. The windows provide both cross-ventilation and an unusual amount of light."

All cabinets are strategically placed. A board to hang tools on is set above the PSM workbench (Sept. '55, p. 116).

Glass wall brings all outdoors, with back-yard privacy, into the living and dining rooms.





Floor plan points up isolation of work and sleeping areas from "showpiece" living area.

A few steps away is a lavatory where you can wash up after work.

Sliding doors. While laying out the room, architect Matern came up with a real masterpiece of planning—the use of sliding doors between the workshop and the garage.

"Every square foot of a house," he says, "costs money. You want to use this footage in as many ways as you can. With the sliding doors, you can borrow space from the garage and more than double the area of the workshop."

Sliding doors also give you quick access to shop tools that are so close to your car. And they have another advantage. In summer you can shut the doors into the rest of the house to keep out insects, open the garage door and enjoy the weather. Matern has used similar sliding doors to give access to the porch, yard and garden from the family room, the dining and living rooms and the master bedroom.

The PSM home is planned to meet all of today's trends:

Family room. This is a distaff version of the do-it-yourself room—a pleasant place to do ironing and sewing. It doubles as a music and recreation room.

Easy housekeeping. With so many

[*Continued on page 260*]

You can get all data needed to build the PSM Workshop House for yourself. For four sets of blueprinted working drawings, plus specifications, a lumber list, and estimating and building-procedure data, send a check or money order for $35 (add $1 for air mail) to Rudolph A. Matern, Architect, 90-04 161st St., Jamaica 32, N. Y.

New Aids For Your Kitchen

1 **Retractable cords** pull out from spools in this appliance center. Part of a packaged kitchen unit including sink, range and other facilities, the panel also has two regular outlets. A built-in radio is mounted above.

2 **Inside door opener** on this Admiral refrigerator is one of two new safety devices designed to prevent children from being accidentally locked inside. A few pounds' pressure on the large plate will open the door. Magnetic catches on new General Electric models also permit doors to be opened by applying light pressure from inside.

3 **Sliding shelves** in the oven of the electric range at left automatically move out when the double doors open. A tug on either door opens both at the same time. A rotisserie can be installed in oven as optional equipment.

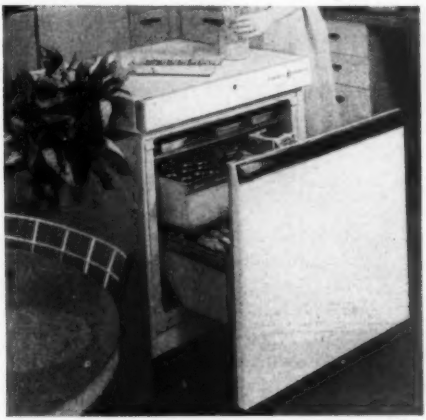
4 **Removable griddle** at right has no heating elements inside to interfere with washing. It rests on two of the range's electrical units and has a special plug that interconnects them for simultaneous automatic operation.

5 Smokeless oven has this wire filter, coated with a chemical catalyst, that heats to 650°. At this temperature, the catalyst converts smoke into harmless amounts of carbon dioxide and water that evaporate.

6 Vegetable bin swings out on this refrigerator door to save reaching inside. You can also remove the bin and use the 1½-foot-deep rack to store milk cartons and soft drinks. Bin holds two-thirds of a bushel.

7 Built-in blender mounts flush in any counter top, is motor-driven from below. Interchangeable attachments include an electric mixer, knife sharpener and fruit juicer. Control gives six speeds for different jobs.

8 Extra outlet panel gives you everything that you need to operate up to four electrical appliances at one time without danger of overloading. It has an electric clock and timer, one timer-controlled outlet, and three regular outlets. The 115-volt panel is wired to a separate circuit to provide safe current capacity.



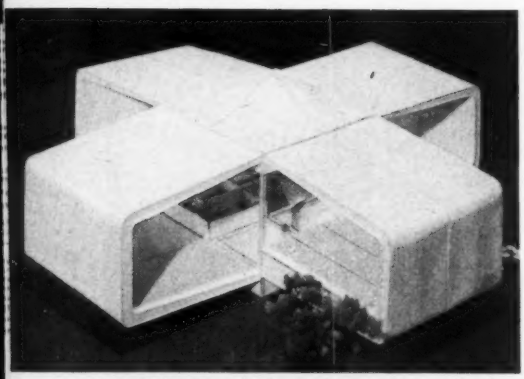
9 Side-opening freezer is just short enough to slide under a standard counter, or it can be used free-standing as a work top itself. The five-cubic-foot compartment is 34⅜″ high, 30½″ wide, and holds 173 pounds. It has a nine-position temperature control, four ice-cube trays, a roll-out door, and comes in six colors.

Further information about the products shown on this and the preceding page can be obtained from: 1. General Electric Co., Appliance Park, Louisville 1, Ky.; 2. Admiral Corp., 3800 Cortland St., Chicago 47; 3. Frigidaire Division of General Motors, 300 Markham St., Dayton 1, Ohio; 4. General Electric Co., Appliance Park, Louisville 1, Ky.; 5. Frigidaire Division of General Motors, 300 Markham St., Dayton 1, Ohio; 6. Hotpoint Co., 5600 W. Taylor St., Chicago 44; 7. Nutone, Inc., Madison and Red Bank Roads, Cincinnati 27, Ohio; 8. Globe American Corp., Kokomo, Ind.; 9. General Electric Co., Appliance Park, Louisville 1, Ky.

Plastic House

of the future may come in mass-produced, no-upkeep parts that you arrange to suit the whole family.

By ERNST BEHRENDT



FIRST MODEL of plastic house shows the four U-shaped wings cantilevered out from a small central foundation. Actual test house, scheduled for '57, will follow a similar design.

MIT ARCHITECTS Marvin Goody (second from left) and Richard Hamilton (center) plan "House of Tomorrow" with Monsanto plastic experts Gigliotti, Whittier and Hansen.

THIS is the schedule for the plastic house in which you may live a few years from now:

- The preliminary design has been completed at the Massachusetts Institute of Technology.
- A scale model will go up some time this spring.
- A life-size test house may be ready in a year.

What will happen after that is anybody's guess; but a brand-new multi-million-dollar industry could result.

There will be a lot of concrete and maybe wood and steel in the house—where concrete, wood and steel can be used more advantageously than plastics. But plastics will be the very backbone of the structure. They will be used for its floors, walls and ceilings; they will line the bathroom, decorate the living room and support the roof.

The project began in 1953 when the Monsanto Chemical Company, one of the largest producers of plastics, offered to sponsor research. Work has been going on ever since under the direction of Richard W. Hamilton of MIT's Depart-

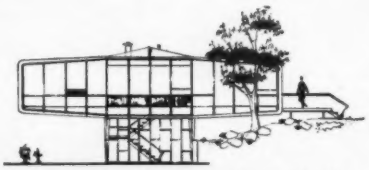
ment of Architecture. The preliminary design was completed in 1954 by architect Marvin Goody with the help of Ernest Kirwan.

What will the plastic house look like? Imagine a big chunk of concrete, 16 feet square. This is the central utility core of the house, and its anchor to the ground as well. It contains baths, kitchen and laundry; the heating plant will probably be underground. From this core four lightweight plastic wings are cantilevered. Each of these, too, is 16 feet square. Seen from above, the four

wings form a cross with the utility core at its center.

This floor plan affords some unusual advantages: In spite of the relatively large size of even the simplest plastic house model—1,280 square feet—only an area 16 feet square has to be excavated for the foundation. The cantilevered wings, floating in mid-air, can be suspended over almost any kind of surface, sloping or level. You can turn the space under each wing into a carport, a patio, a tool shed or a sheltered playground. You would get an extra 1,024 square feet of usable area "free."

The wings are the most remarkable feature of the plastic house. These are not just the familiar plastic panels, but the closest approach yet to prefabricated rooms. Big sheets of plastic, approximately three inches thick, are molded to a U shape that is eight feet wide and 16 feet long. Lay the U on its side and you have a floor, wall and ceiling—all in one piece. Take two of these plastic U's and join them side by side, and you have the large wing, 16 by 16.



SUPPORTING PEDESTAL adapts plastic house to any terrain, sloping or flat, without changing design. Utilities, in core, can be above or below ground.

The wing's floor and ceiling flare toward the central core. This flared construction makes the unit much stronger. It also permits the units to nest, and all eight units for the MIT house could probably be stacked like baskets on one truck trailer.

Angled ceilings are popular nowadays, but nobody wants slanted floors. So a 16-foot-square wedge—thin end pointing away from the central core—gives a level floor. It also increases rigidity, so that the wing will not bounce as you walk on it.

Molded in the plastic wedge are deep grooves for all the ducts and pipes that your house is likely to need. A later model may have continuous wiring strips in the walls, luminous panels in the ceilings and other refinements.

Will your plastic house look exactly like a hundred others? Not at all, say the planners. The plastic house will be one of the most flexible structures ever designed. Remember that the wings are made with two sides wide open, supporting no weight. You can make them of any material that suits your taste: asphalt shingles, plywood panels, picture windows—even plastics.

Adding a room or two or four is a simple operation once you build a second core some distance from the first. You can then cantilever new wings without further excavating. You can even join a third half-wing to a unit of two and have a 16-by-24-foot room.

It is just as easy to remove a wing when you no longer need it. A market for used wings may develop eventually. You may one day go to a secondhand-wing lot and pick out a well-preserved room formerly owned by an elderly schoolteacher who occupied it only on Sundays.

The plastic house is just as flexible inside. You can leave a 16-by-16 room as it is or divide it with partitions. You can paint the house inside or out, wallpaper, or leave the plastic's own color.

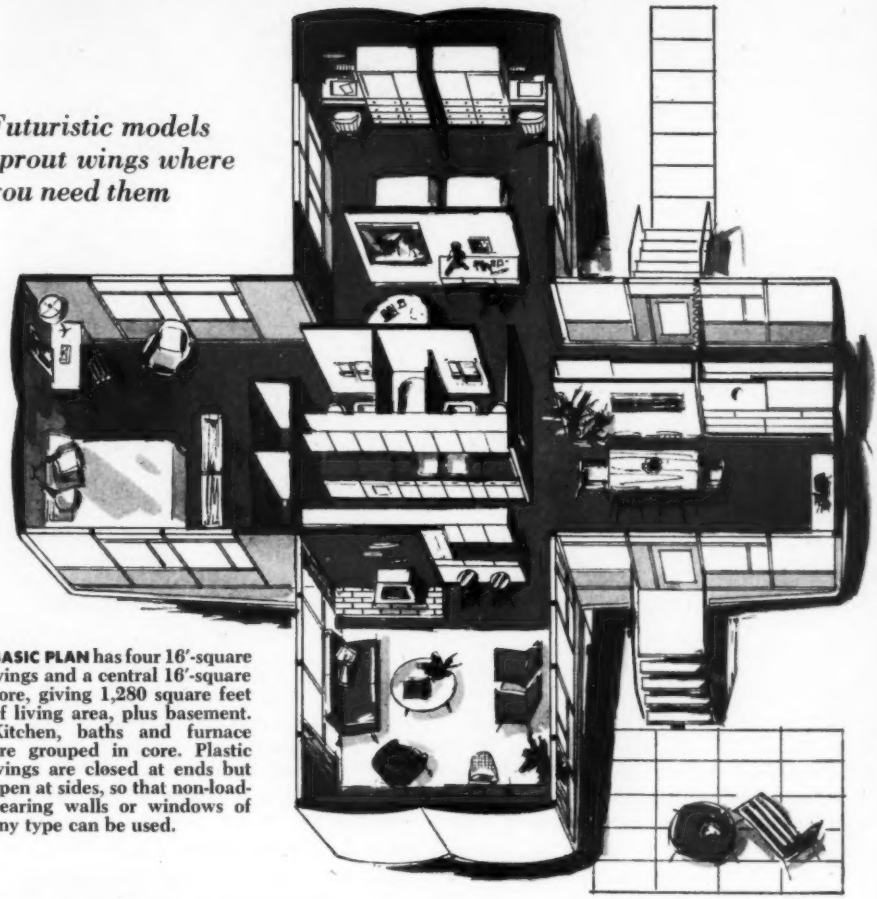
Insulating the house will probably be a cinch. Termite-proofing it will be still easier—termites don't eat plastics. Fungus-proofing won't be necessary at all. Fire-proofing is a different problem. Some plastics are fire-retardant; others, including some foamed plastics, are not.

Ease of maintenance may turn out to be one of the greatest assets of the plastic house. The walls can be washed or even hosed down. Some plastics will hold nails for hanging pictures or shelves. For those that do not, wooden nailing strips may be molded into the surface.

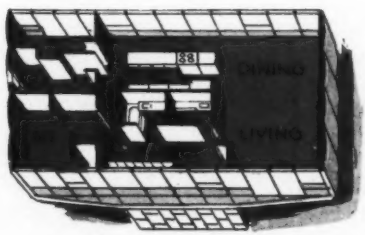
In the plastic house a tube of cement may replace the handy man's hammer. You will use it to fill nail holes, seal

[Continued on page 262]

Futuristic models sprout wings where you need them



BASIC PLAN has four 16′-square wings and a central 16′-square core, giving 1,280 square feet of living area, plus basement. Kitchen, baths and furnace are grouped in core. Plastic wings are closed at ends but open at sides, so that non-load-bearing walls or windows of any type can be used.

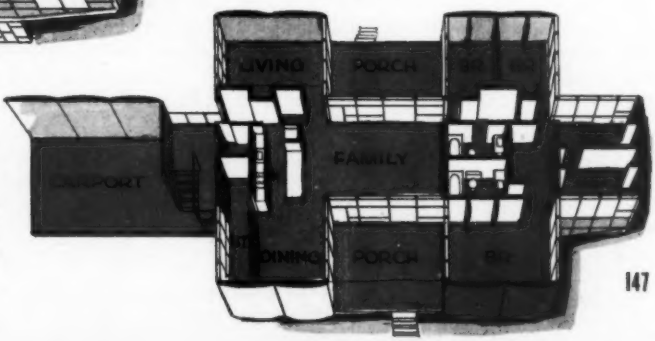


"Conventional" plan is a T shape

RECTANGULAR HOUSE (left), arranged much like present ones, could be made by attaching doubled wings to each side of a doubled core. This gives 1,536 square feet of living area, plus large 16′-by-32′ cellar above or below ground.

"Mansion" may look like this

TWO OR MORE CORES, connected by "bridges," make any size house. Here, 2,560 square feet of area are supported on only 512 square feet of foundation.



A summertime haven, this

Screened Terrace

banishes sun glare by day, bugs at night. It uses a special kind of screening to give a one-way window on the garden

HALF-ROOF keeps off rain

SIMPLE FRAMING goes up fast

SPECIAL SCREENING for shade, privacy

BY JERRY PARKER

EVEN in California we have bugs. But I escape them now in a new kind of summertime retreat that is better than the old screened porch.

This half-roofed, screened terrace takes advantage of recently developed materials and ideas to:

- Keep the bugs out, but let every delicate breeze in.
- Block hot, glaring sun rays, but pass cheerful, indirect light.
- Allow a clear view of the garden, without letting neighbors see that I am stretched out in my undershirt.
- Protect the furniture from rain.

The half-roof is a smart idea that is gaining wide popularity. I used corrugated aluminum to cover the terrace near the house. The other half of the terrace is covered with the same screening that encloses the sides. More breeze gets in and I can even stargaze in comfort on pleasant summer nights.

The screening is a special kind called Shade Screening. It looks like a miniaturized venetian blind, with tiny horizontal aluminum strips tilted at an angle.

The angled strips give the screen its special advantages. Direct sunlight is blocked, but not soft, reflected light. And you have privacy. Standing a little distance outside the screen, you see the flat sides of the strips—which effectively curtain the terrace. From inside, the strips appear edge-on and you get a clear view when looking out.

Shade Screening comes in rolls of various widths (from 18″ to 24″) and can be stapled or tacked to simple wood frames, just like ordinary screening. It is sold by most building-supply dealers at about the same price as other quality screening.*

My terrace uses the house for one wall and a big chimney for part of another. An open, concrete terrace was already there, so I had no floor to make.

The 12-by-15-foot area was framed over with redwood two-by-fours (redwood is cheap here). Simple screen frames were made of one-by-two and one-by-four redwood. The whole job took three weekends and cost $125.

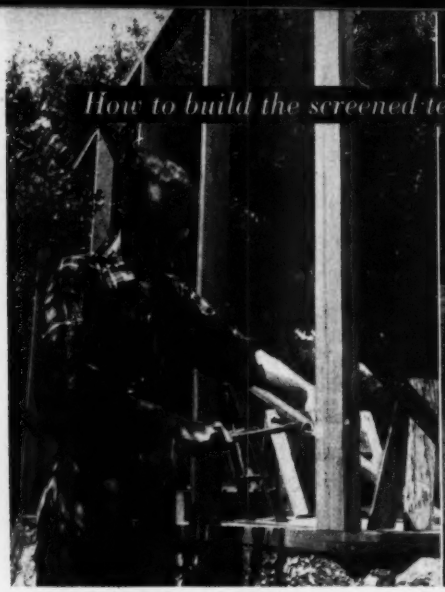
*Shade Screening is manufactured by Kaiser Aluminum and Chemical Corp., Oakland, Calif.

Pages 150-151 show how you can build the screened terrace

Cool light filters onto the terrace through Shade Screening. And you can still see out.

Like a one-way window, special screening reflects most outside light, assuring privacy.

How to build the screened terrace



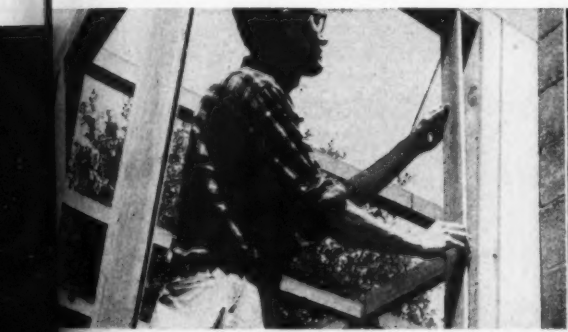
1 **STUD SPACING** was worked out so that all screens would be same size. Front wall went up first, on top of sill nailed to foundation.

2 **KICKBOARDS** are essential if you have small children. These one-by-tens were nailed to wood cleats that had been fastened to studs.

5 **HALF-ROOF** was made of 4'-by-6' corrugated aluminum sheets. Aluminum nails fastened them to two-by-four purlins laid on top of the rafters. The remaining roof openings (left in photo above) were filled in with the same screening used for the sides of the terrace.

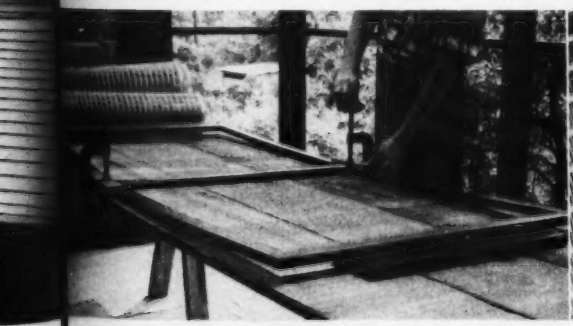
3 **ANCHOR RAIL**—a two-by-four nailed to the house studs—supports the roof at the house. The house forms the back wall of the terrace.

4 **RAFTERS** are two-by-fours, spaced to match screening width and toenailed to plate. Another two-by-four closes in rafter front ends.

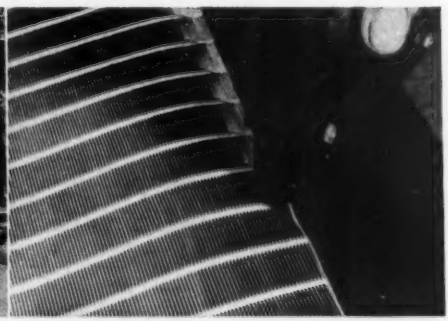


6 **TRIM** of ½"-by-2⅞" stock was nailed to the sides of each stud. The screen frames fit snugly against the trim when put in place.

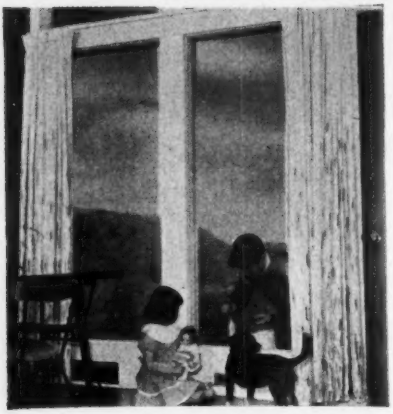
7 **SCREEN FRAMES** were painted before screening was attached. Frames are one-by-twos (one-by-four at bottom) butted, glued, fastened.



8 **TIGHT SCREENING** came from bowing frame lengthwise, with blocks under ends, clamps in middle. Only vertical tightening is possible.



9 **STAPLER** puts screening on quickly. Staple each vertical strip to the frame at top and bottom, holding stapler at a 45° angle. END



Window

Installing them is a job

YOU can update a dark and dingy room, or turn an open porch into a real working part of your house, with picture windows or window walls. Big glass areas like the one below will frame a favorite outdoor view, brighten

Walls *make any house look up to date. that you can do. Here's how in step-by-step photos.*

the house interior and give you controlled ventilation. If the window faces south you'll get another dividend—solar heat.

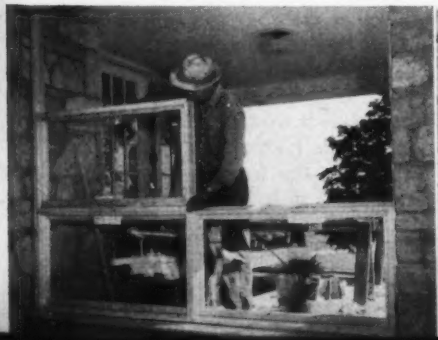
The simplest way to build a window wall is to frame an opening and install a number of factory-made window units as shown below. These units come all ready to install in a variety of sizes. For a big expanse of glass that exactly suits your house, however, you may prefer to build your own window units. The following four pages show you how.

TO ENCLOSE A PORCH with stock units,* frame openings with two-by-fours. Spread calking underneath and fasten to stonework with masonry nails or screws and expansion shields. Shim frame where necessary to get it square.

NAIL FIRST UNIT in a bottom corner of the frame after prime-painting all units (keep paint off weatherstripping). Toenail other bottom units in place and join the units with corrugated fasteners at 8" intervals, inside and out.

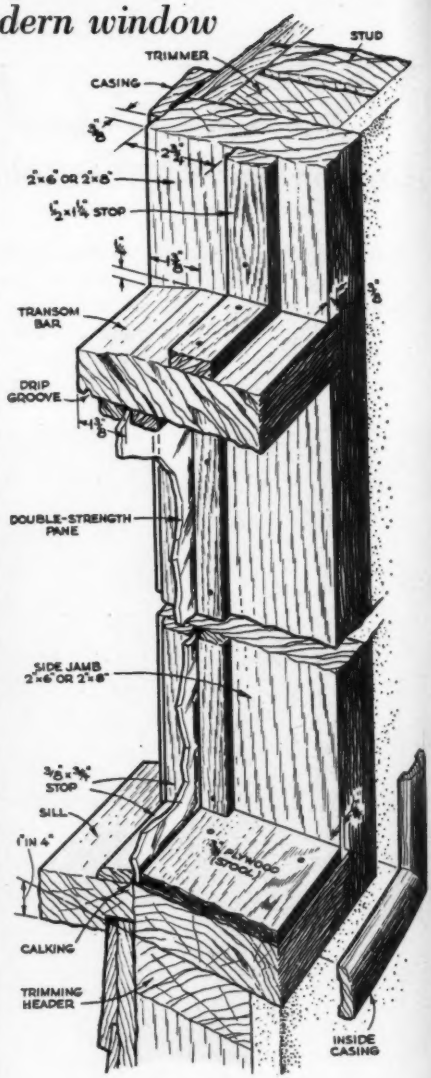
CENTER AND UPPER UNITS in this installation were placed so that the sashes swing out at the bottom. The bottom units were reversed so that the sashes swing inward at the top.

*Flexivent units here made by Andersen Corp., Bayport, Minn.



COVER JOINTS between the window units with simple batten trim inside and out. Besides making the joints weathertight and hiding them, this trim covers the corrugated fasteners. Cut side trim to fit stone or siding closely.

How to build your own modern window



THIS custom-built window combines large fixed panes with transoms for plenty of ventilation and the modern big-view look.

Use the assembly drawing above to identify the parts. Dimension the window to suit yourself, keeping the following facts in mind:

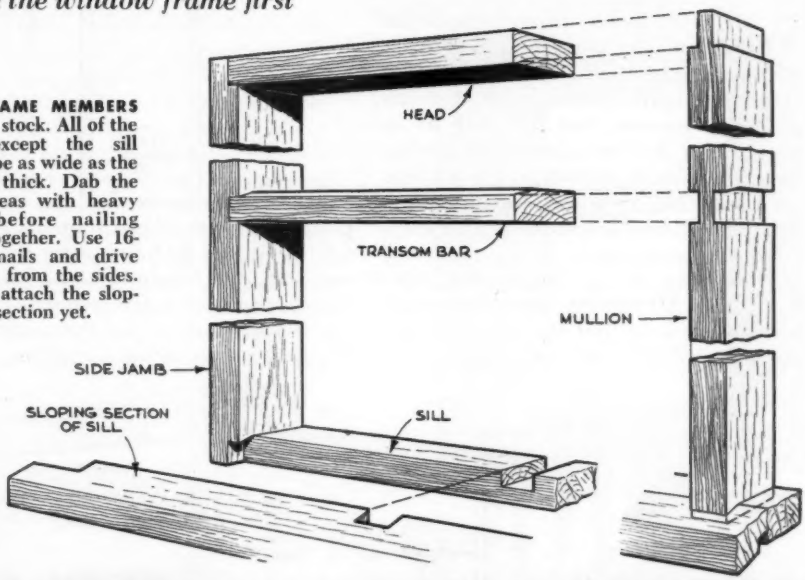
1. The width of each window-and-transom unit—you combine two or three units in a single frame—should not exceed three feet.

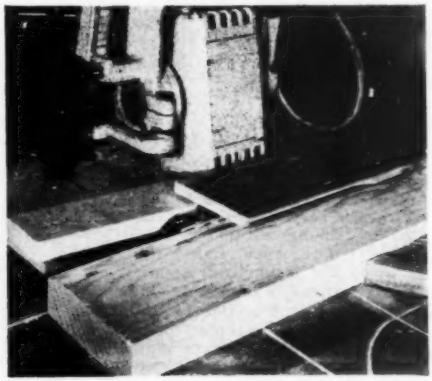
2. The crossbar that separates the fixed panes from the transoms looks best if set above eye level. Six feet above the floor is a good height, though many housewives would prefer it a little lower, to put the transoms within easier reach.

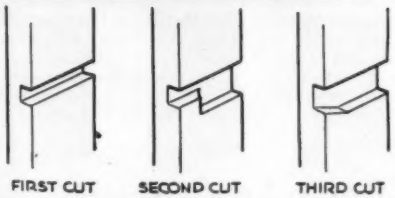
3. Size the transom openings to take stock-size sash. They'll save you money.

Make the window frame first

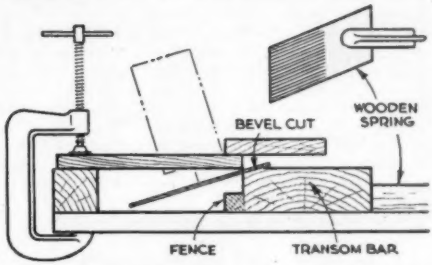
CUT FRAME MEMBERS from 2" stock. All of the parts except the sill should be as wide as the wall is thick. Dab the joint areas with heavy paint before nailing them together. Use 16-penny nails and drive them in from the sides. Do not attach the sloping sill section yet.







RADIAL OR CIRCULAR SAW speeds the framing. Slots for transom bars and rabbets for the sill shoulders can be cut in the jambs with three passes of a dado head (sketch). If you use hand tools, make the sloping cuts with a chisel.



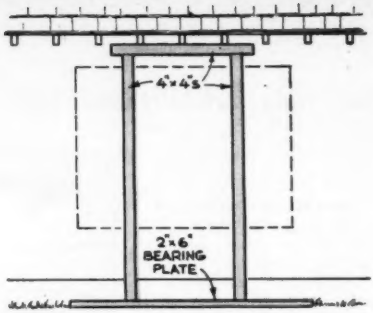
THIS IS THE SAFE WAY to cut a bevel on a transom bar with a radial saw. Blocked-up scraps of wood clamped to the table cover the blade. A wooden spring holds the work firmly against the fence, offsetting the saw thrust.

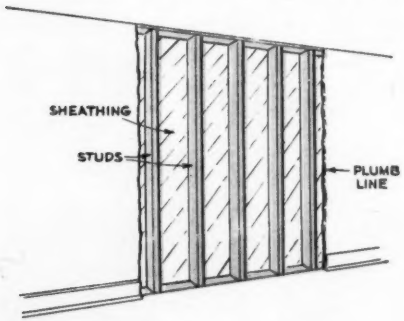
Please turn the page for more on fixed windows

Cutting safely through a wall

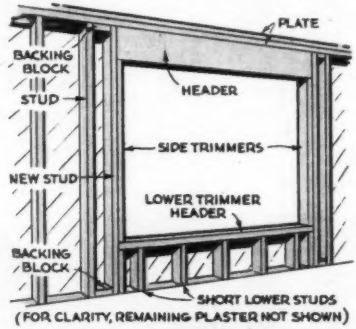
WHEN you break through the frame wall for your window, you weaken the wall by removing load-bearing studs. Once you have boxed in the opening properly, however, the wall will be as strong as it was originally. But during the hour or less it takes to do this job you must leave the sheathing and siding intact to reinforce the opening temporarily.

On a two-story house, or the gable end of a one-story house, the sheathing offers plenty of support for a three-unit window opening. But the sheathing on the side walls of a one-story house gives practically no overhead support. To play safe, prop four-by-fours under the rafter ends outside a one-story house before removing the studs in the window opening. Use a two-by-six under the props for a bearing plate, as shown in drawing above.

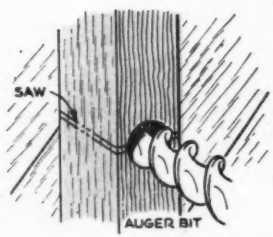




SCRIBE VERTICALS from the ceiling to floor on the inside plaster wall where the window sides will fall. Spread cloth on floor to catch debris. Cut plaster with an old compass saw, then tear it all off. A drill helps to cut out studs (right). Bore 1" holes just inside wall opening and saw through remaining stud sides. Pry out the section of studs between the cuts. Splinter the remaining stud ends with a chisel and pry out fragments.



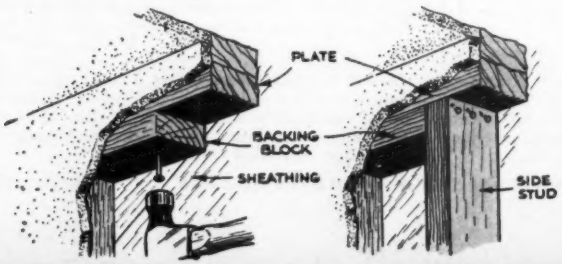
BOXING SCHEME: Backing blocks space new studs correctly for the opening. The side trimmers support the ends of the header. The lower trimmer header and the cripples take the downward thrust of the jambs and mullions, once the window frame has been put in place.

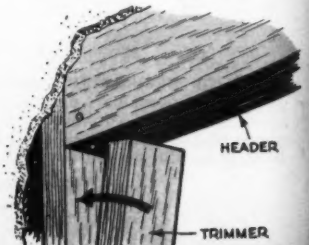


BACKING BLOCKS should be as long as the distance between the stud nearest the window opening and the edge of the opening, minus 3½" (the thickness of a new side stud and a side trimmer). Nail the backing blocks between the inner and outer wall areas, as shown below.

FORCE NEW STUDS between the inner and outer walls, placing their ends against the backing blocks. Toenail in place. After the other members are installed, the wall area above and below the window must be covered over with plasterboard, or lathed and re-plastered.

USE DOUBLED TWO-BY-SIXES for a header. Force it between studs. Install the cripples and nail the lower header in place. Then drive the side trimmers home between the headers. Finally, saw out the sheathing and siding. Leave a ⅜" projection above the lower header.

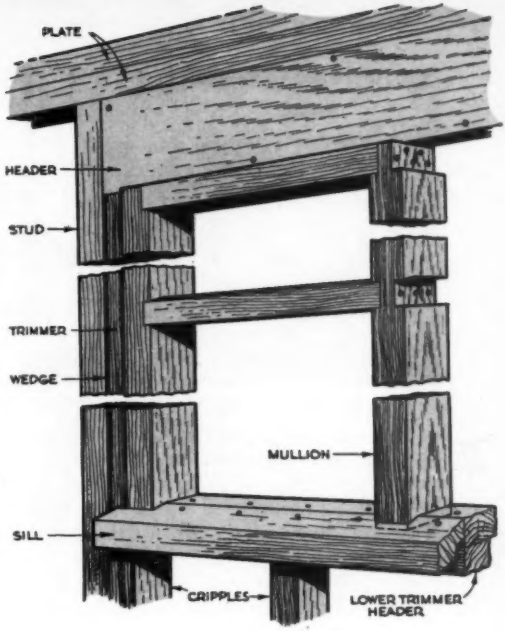




Truing up the frame

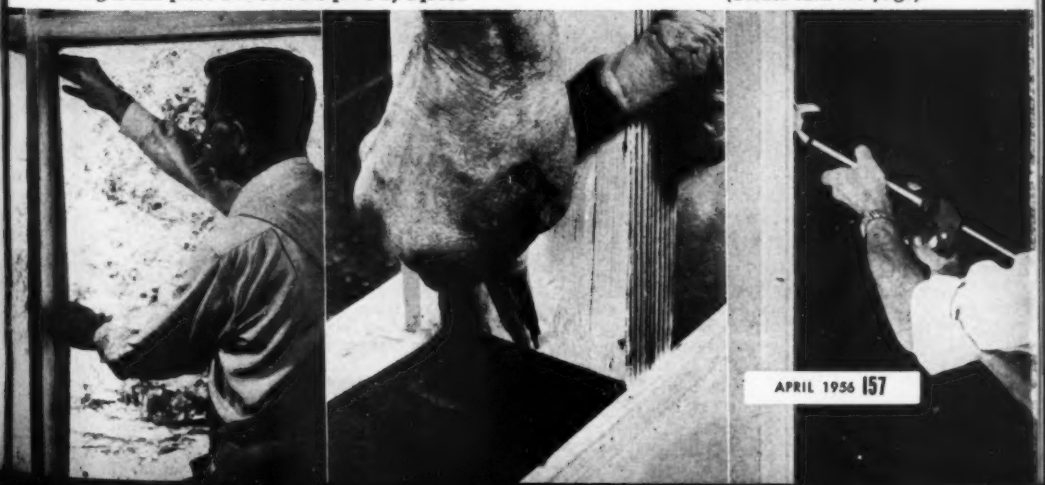
IF YOU have done a good job of building the frame and reinforcing the wall opening, everything will be plumb and you should have no trouble inserting the frame in the opening.

Set the frame flush with the wall edges and, if the jambs are plumb, nail one jamb against its trimmer, placing nails where the stops will cover their heads. Check the sill with a level, then wedge the opposite jamb in place with shingle points and nail it to the trimmers. If the framing isn't plumb with the trimmers, adjust with wedges on both sides. Fit the rabbet in the underside of the sloping sill section over the ⅜″ lip that you left projecting over the lower trimmer header. Then nail the sill section in position. Finally, nail the siding ends to the trimmers.



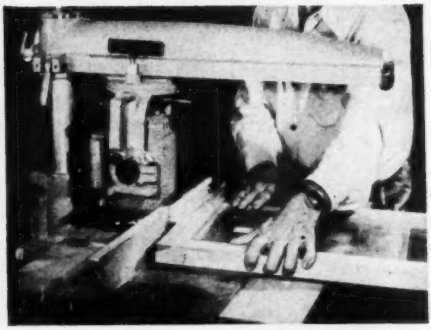
For a weather-tight window, use this glazing method

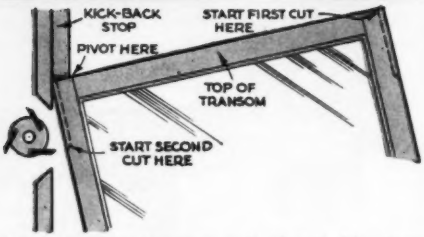
CUT stripping for the outside and inside stops from one-by-twos. Bevel one edge to form V-shaped pockets for calking mastic. Use ¾″ exterior plywood for the stool that forms the lower stop. Cut this member slightly longer than the frame opening, so that it can be trimmed to a snug fit when it is installed, as described below. Prime the stop strips and the stool. Just before installing each stop member, paint its frame-contacting surface again.



GAUGE PENCIL LINES on the frame for outside stops. Place the horizontal stops first, using fourpenny nails about eight inches apart. Cut the vertical stops a trifle long and spring them into place (left). Nailing them flat will bring them to a snug fit. Run mastic around edges of the stops. Lay two cardboard shims on sill. Rest glass on the shims and against the bottom stop. Swing it into place and seat the pane by squeezing it against the stops with a softwood stick. Next, trim the stool for an exact fit, scribing for saw cuts (center). Bevel the bottom edge of the stool where it butts against glass. Apply mastic to the bottom edge of the windowpane, press the stool in place and nail down. Then squeeze mastic around the rest of the pane (right) and secure by positioning the inside stops.

(Please turn the page)





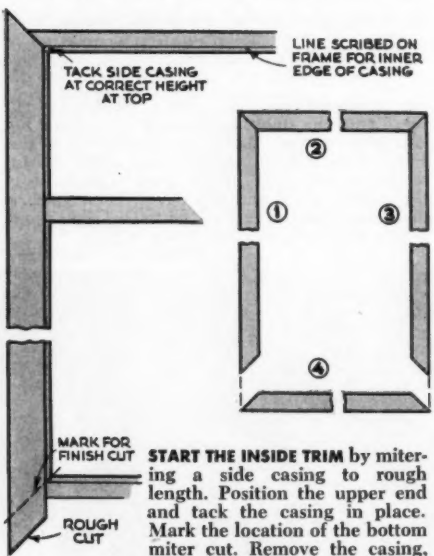
BLIND RABBETS at upper ends of sash sides form pockets for hanger arms. If you use a shaper, make one cut from a top corner. For the other rabbet, use the setup shown above and start the cut at the blind end of the rabbet. Then backcut to the corner of the transom.

Transom-hanging tips

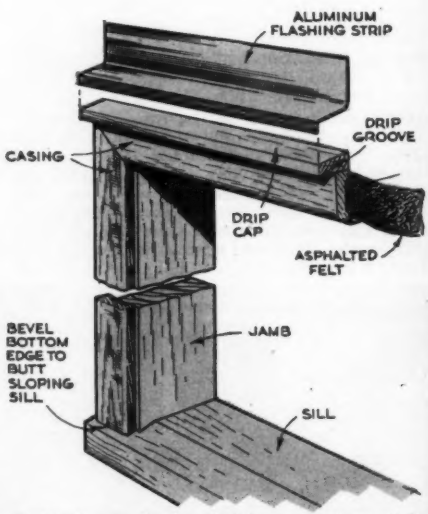
STOCK sash used for the transoms should be trimmed to give 1/16″ clearance all around. Drive nails in the frame for temporary stops so that you can check the transom clearance. When transoms fit, install permanent stops. The standard 8″ hangers shown here use friction to hold the transom open. Paint the transoms before applying the hangers.

WITH HANGERS SCREWED TO THE SASH, open them equally and enter the sash from the outside. Mount one hanger. Swing the other end in and attach the second hanger. If the sash binds slightly, hold a block against the rubbing corner and rap sharply with a hammer.

The final step—applying the trim



START THE INSIDE TRIM by mitering a side casing to rough length. Position the upper end and tack the casing in place. Mark the location of the bottom miter cut. Remove the casing, make the cut, then nail in place. Fit the head casing next, and so on around the opening.



OUTSIDE, cut the beveled bottom edges of the side casings first. Tack and mark for miter cuts. Sandwich strips of felt between the frame and casings. Work flashing under the nearest siding board before placing the window cap. Screw-nail the flashing to the cap.

Installing New Appliances

is the quick way to modernize your home. Here's what it takes in time, money and skill.

By EDWARD D. FALES JR.

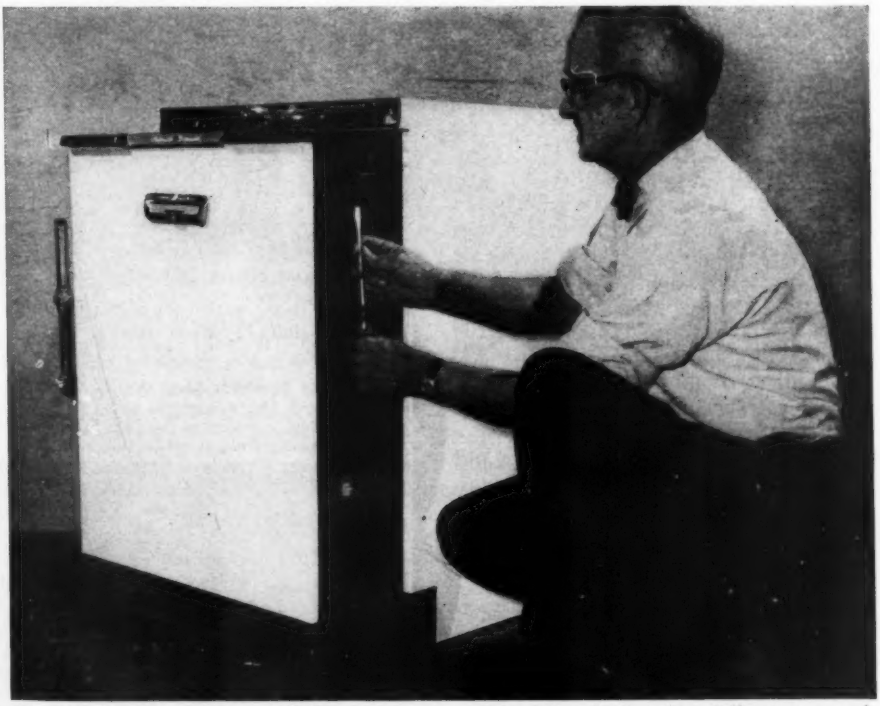
THE mark of a 1956-model house is not its size or shape or color, but how much up-to-date machinery it has to make living easier.

The '56 machines that wash the cups and cool the people are markedly different from their counterparts of only a few years ago. They do a better job. And all are often built in as parts of the house.

How many you can have depends mainly on your pocketbook. A man of average skill can cut the cost substantially by putting them in himself.

It costs $35 in some cities to have someone install a garbage disposer, $50 to $75 for a dishwasher installation, $35 or $40 to have an air conditioner put in your window. You should be able to save much of that.

Installation cost depends partly on



John Blank, GE expert, reveals how pros put a dishwasher in fast (see following pages).

where you locate your appliance. The closer it is to plumbing and electrical lines, the less you will spend for connections.

You may also save on the prices of appliances themselves by shrewd shopping.

Skill and tools. Reasonable competence at simple electrical work and carpentry will see you through. Such tools as electrician's snakes and pipe-threading dies are rarely called for. With many water-using appliances these days, synthetic-rubber hose is used; and those that are permanently set in can be connected with seamless copper tubing, with soldered joints or compression fittings.

Here are some general points:

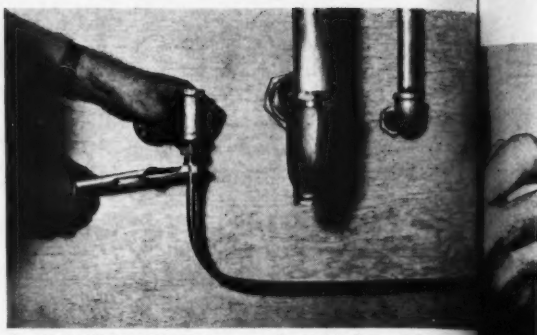
•Circuits. Most appliances need plenty of juice. You may have to give some of them a private line to the fuse box. If you don't have spare circuits, it may pay you to have them put in.

•Grounding. The housings of *all* home appliances should be grounded for safety. Where this is not done automatically via metallic plumbing or BX armor, be sure to add a reliable, permanent connection to ground.

•Voltages. Appliances drawing heavy current—ranges and ovens, electric clothes dryers and water heaters, and larger air conditioners—are not always standardized at 220 volts. And depending on where you live, you may have from 208 to 240 volts. Since a stove built for 230 volts will work about 10 percent slower on 208 volts, you should order a stove rated for your voltage.

Here's a report on new appliances, and on the carpentry, wiring and plumbing that they involve.

Air conditioning. Most window units need no plumbing. The new models in the smaller sizes (⅓ and ½ horsepower) draw only about eight amperes. They can be plugged into any 110-volt outlet, as long as the circuit is not already heavily used. Installation is mainly a matter of mounting the housing in the window and

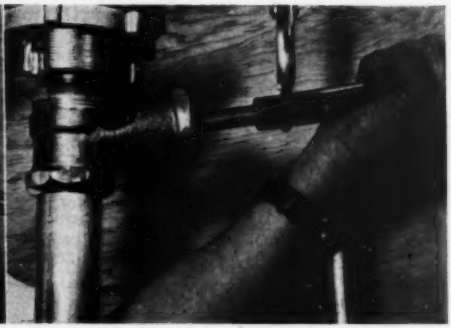


1 HOT-WATER SUPPLY comes from kitchen-sink pipe. Elbow is replaced with tee, into which compression fitting for copper tubing is screwed. The pipe to the sink can then be replaced.

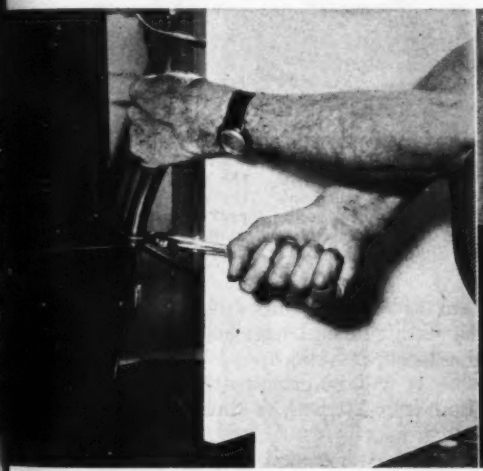
4 WASHER TUB COMES OUT after both roller bumpers are removed (inset). When front rollers clear slides, front of tub is lowered to floor. Then slides go back, rear is lowered.

7 ELECTRICAL CONNECTIONS: Water-inlet leads are plugged into automatic valve (below). Cable from house wiring is brought to box and connected, white wires to white, black to black.

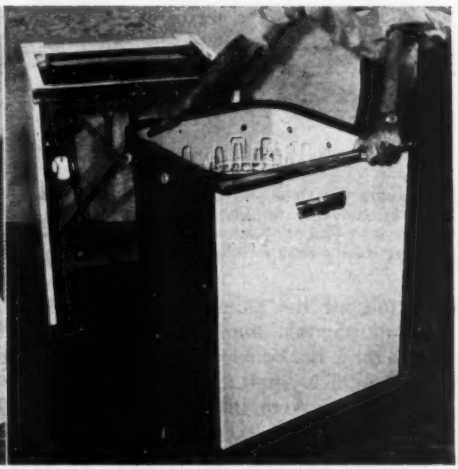
2 SINK DRAIN serves washer. Pipe that connects sink to trap is removed and marked for shortening (above). It will be cut just enough to accommodate a special connector.



3 DRAIN HOSE is clamped to short tubing soldered into connector. Neither hose nor supply line is yet connected to washer, so that there is plenty of room to work on plumbing.



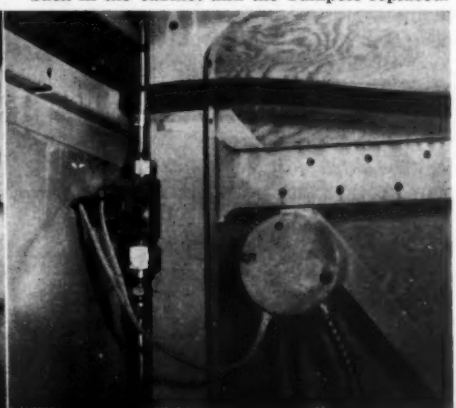
5 TUB DRAIN is unclamped after tub rests on floor. This hose is not the other end of hose hooked to sink drain (photo 3), but a separate one attached to copper tubing in the cabinet.



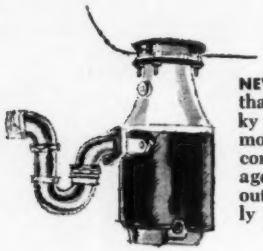
6 TUB CAN BE MOVED AWAY after cover is taken off electrical junction box (inside cabinet). This makes room to screw the cabinet to wall and connect electricity and plumbing.

8 DRAIN HOSE from sink pipe is clamped to drain tubing inside cabinet. Hose at other end of this tubing is reattached to washer tub when the tub is to be replaced in the cabinet.

9 WATER-SUPPLY TUBING comes up to connect to automatic valve with compression fitting. Now tub drain hose can be attached, tub put back in the cabinet and the bumpers replaced.

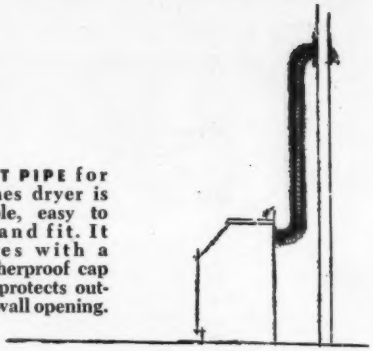


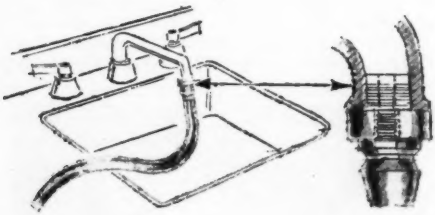
*The right accessories speed installation**



NEW SINK TRAPS that replace bulky old-fashioned models help you connect the garbage disposer without making costly pipe changes.

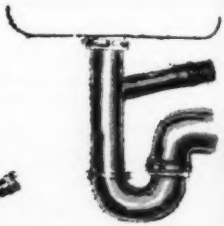
VENT PIPE for clothes dryer is flexible, easy to cut and fit. It comes with a weatherproof cap that protects outside wall opening.





HOSE ADAPTER lets you fill washing machine from kitchen-sink faucet. Self-tapping adapter screws into faucet. Some kinds have a quick-connect fitting that lets hose snap on and off.

WITH LONG HOSE you can locate washing machine where you want it and still hook it to existing plumbing. The hose comes in almost any length.



READY-MADE TEE, which fits in place of the pipe connecting the sink to the trap, provides an easy way to hook a pump-type dishwasher to a drain.

blanking off the sides of the opening. The job may take two to four hours. You will want a husky friend around to help horse the heavy unit into place.

Whole-house conditioning is easier and cheaper ($600-$1,000) now with prefab plastic ducting that you can put in the attic (see page 164). There is no sheet-metal work, but you have to chop several holes in ceilings. You also need a 220-volt line to operate the cooling unit, and some way to hoist it to the attic.

If you already have ducts, for warm-air heating, you can hook any one of many types of units right to them. This also takes 220-volt electricity, and for water-cooled outfits, plumbing.

Whatever system you plan, here are good points to keep in mind:

• It may be better for several reasons, engineers say, to buy a unit a little too small rather than one that is too big. You can get good results from a small unit by letting it run longer hours—so the heat load doesn't build up.

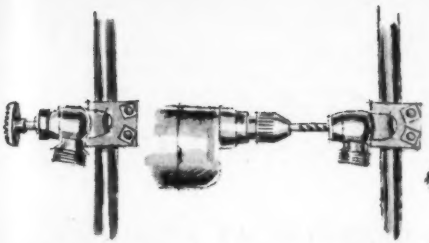
• It will be extra-costly to air-condition your kitchen. It throws off far too much heat.

• A water-cooled unit may be more reliable on very hot, muggy days, but it needs plumbing. And it uses a good deal of water—unless you install an outdoor cooling tower.

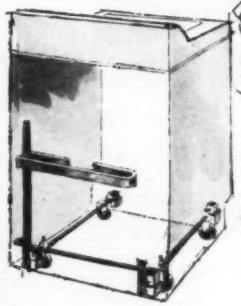
The newest kitchens have ovens, ranges, refrigerators and freezers that look like part of the cabinetry. One expensive refrigerator-freezer (General Electric) resembles a ready-made cupboard—you just hang it from a steel angle lag-screwed to wall studs.

Built-in refrigerators and freezers, which cost about the same as de luxe free-standing models, fit into enclosures that you make: "boxes." These are actu-

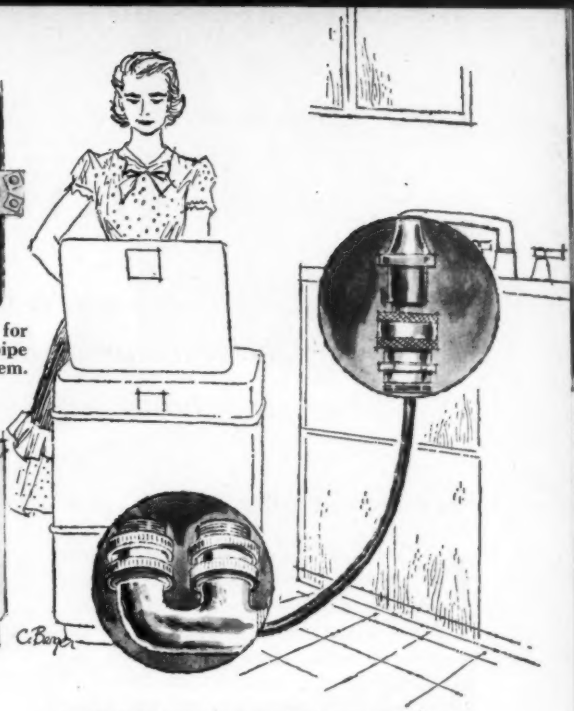
**Further information about accessories shown here can be obtained from: General Electric Co., Appliance Park, Louisville 1, Ky. (waste connectors for disposers and dishwashers); Flexible Tubing Corp., Guilford, Conn. (dryer vent); P-G Products Mfg. Co., 1455 Boston Rd., New York 60, N.Y. (all others shown).*



SADDLE VALVES quickly provide faucets for clothes washers. Valve body clamps around pipe and guides drilling of hole for the valve stem.



WHEELED FRAME makes a standard washer portable—it can be used near sink and stored out of the way. A handle lowers the machine to the floor for operation.



TWIN-MIX connects a washer's two water inlets (hot and cold) to one hose when machine must be filled from sink faucet. This arrangement makes machine's mixing controls inoperative.

ally sort of rudimentary closets that you build out from the real wall. Some built-ins have vents (to let air circulate around the machinery) made as part of their fronts. For others you have to build louvers into your box. One maker (Westinghouse) provides separate compressors, which you can install as much as five feet from the boxes, even hanging them from the cellar ceiling if you like.

Refrigerators and freezers draw little juice and plug into a 110-volt outlet.

Electric cooking units need 220-volt lines brought to them. Once that is done, they are easy to hook up, with simple connector blocks and ample BX cable factory-attached. Gas units are connected the same as ordinary gas stoves, a straightforward pipe-fitting job for a knowledgeable handyman.

Ovens fit into boxes exactly as refrigerators do. The oven just slides inside, but must be carefully leveled (or it won't bake evenly). The range drops into a hole sawed out of a counter top. The range flange supports it, and clamps underneath lock it in place.

Garbage disposers ($80 to $120) are simple to install in modern sinks. You remove the drain flange and drop in the disposer sleeve. The disposer itself replaces the drain pipe between sink and trap. It bolts on—no pipe-fitting.

The job is not much more involved with an old-style sink if you make wise use of installation accessories. A number of fittings can adapt the disposer to odd-size drain openings. Some distributors will even lend you a special hole saw, powered by a ½" drill, that cuts a new opening in the sink. Old traps are likely to be too big to accommodate a disposer, but several different replacement traps are made for getting around this obstacle.

Wiring: Disposers need 110 volts nearby, but not necessarily a separate circuit. Some units have their own switches.

Dishwashers ($150 up) go next to the sink where hot water and drain connec-

[Continued on page 266]

Air-Conditioning Kits

that use a new kind of fold-up duct let you install a central cooling system with home tools and a handyman's skill.

By John L. Springer

COMPLETE central air-conditioning systems now come in kits that you can install yourself.

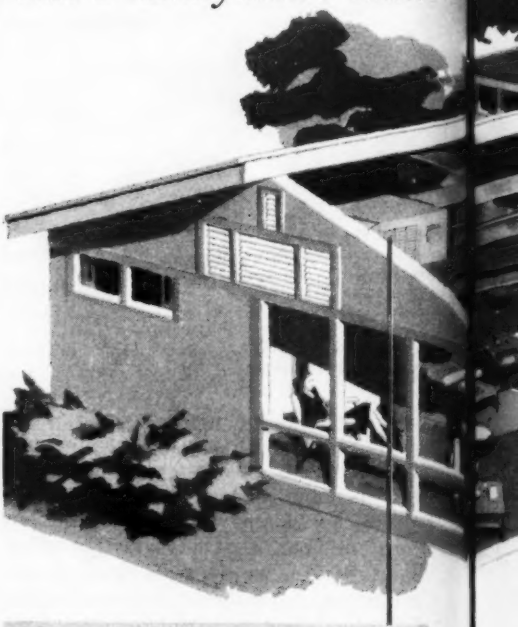
What makes this possible is a new system of light, glass-plastic ducts that you fold together and join into lengths to carry cool air anywhere in the house. There's no metal to cut and fit, no framing needed to support their weight.

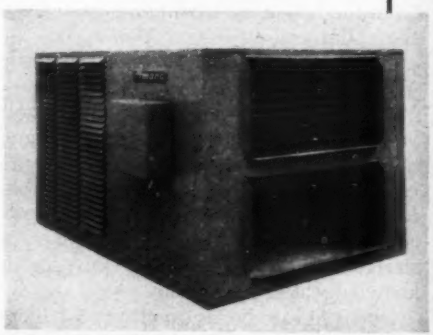
The cooling units used with these ducts require no water. You can set them up in an attic, crawl space or basement. If you already have a warm-air heating system, you can connect this unit to its ductwork.

You can buy one of these new systems for as little as $600 complete—less than half the cost that contractors usually quote for whole-house units.

The kits are designed primarily for one-story houses that have enough clearance, either over the ceiling or under the floor, for you to crawl around in to set them up. If you have an existing outside wall opening 30″ square—large enough for the main cooling unit to pass through—no cutting of joists or wall studs is necessary.

In fact, the manufacturers* have done so much simplifying, eliminating difficult furnace, duct and water hookups, that surprisingly little carpentry is needed

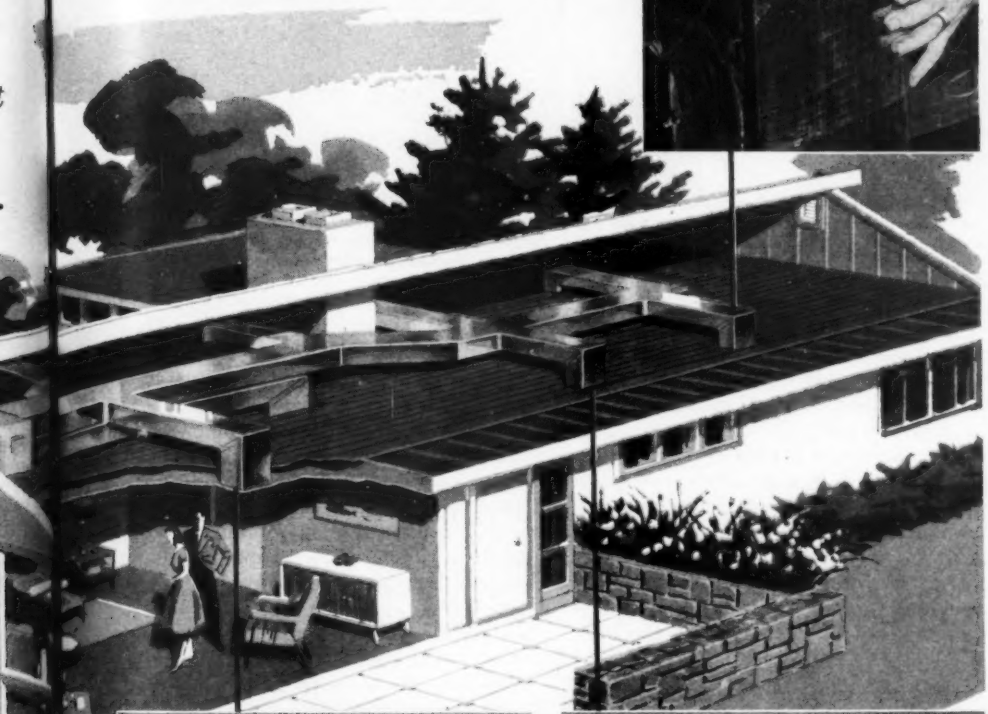




COMPACT COOLING UNIT is mounted behind louvers in end wall of house. Hot room air from a central collector is pulled into lower opening, cooled, then fed to rooms from upper one.

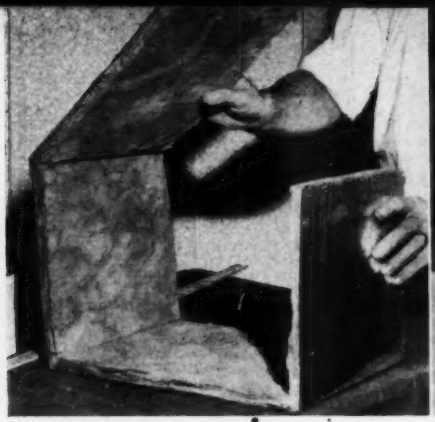
*Among those making kit air-conditioning systems are: Amana Refrigeration, Inc., Amana, Iowa; O. A. Sutton Corp., 1814 W. Second St., Wichita, Kan.; Philco Corp., 445 E. Tioga St. Philadelphia.

AIR DUCTS are mitered and taped together to form the 90-degree elbows that lead from main supply line down into rooms. The ducts are light enough to be tied in place with wire.



SINGLE RETURN GRILLE for collecting warm air is located in ceiling above hallway or other central area of house. Removable aluminum filter is inserted and louver bolted over it.

COLD-AIR OUTLET fits in ceiling of each room. Small diffusing grilles go between joists without framing and are quickly screwed to the ceiling after the ducts have been installed.



DUCTS COME FLAT, are quickly folded into rectangular conduit. Glass-fiber lining ¾" thick is beveled along the score lines so that it bends easily without bunching at the corners.

EDGES ARE COATED with a quick-drying sealing compound before the sections are joined together. The inside surface has been smoothed to minimize resistance to the air flow.

anywhere. In the attic installation, one wall opening for the main unit, two small ones for moisture drain-off, and a ceiling opening in each room are often the only cuts needed.

The parts you get for the $600 price tag include a two-horsepower cooling unit, prefab ducts, a remote-control thermostat, grilles, and all necessary hardware to complete the job.

The two-horsepower conditioner (roughly equal to a two-ton unit) is designed to cool an average-size home with up to 1,500 square feet of floor area. One company (Amana) also makes, for less than $1,000, a 3½ horsepower unit to cool up to 2,200 square feet.

The do-it-yourself conditioner is remarkably simple. In effect, it consists of an oversized window conditioner rigged up with ducts to cover the whole house. But instead of a window, it stands against a louvered wall opening and draws in hot, humid air from the house through one centrally located grille. It then feeds cooled air through separate grilles to each room.

The new ducts are prescored sheets of ¾"-thick glass-fiber board that are delivered flat. On the job, you fold them into a rectangular shape and seal the edges and joints with a special tape.

You can cut and fit the ducts with an ordinary knife. The main supply and return trunks are 10" by 14" and run over or under the floor so that you don't have to cut through any joists. The individual room ducts are 6" square and lead down between the joists to the ceiling, eliminating the need for making breaks in walls and studs.

Templates in the kit help you to make neat, circular cuts in the ceiling for outlets.

If the conditioner is installed in the basement, registers are set in the floor. Engineers say that the attic system is better, however, because it draws off warm air that rises and feeds in cool air that settles. Floor registers are all right, but

HOISTING COOLER TO ATTIC takes a little engineering. You can use block and tackle to get it up there; or, better, borrow a fork-lift truck or a sign painter's derrick to do the job.

CEMENT IS BRUSHED on joints to hold tape that will cover seams. The ducts are surfaced with fire-resistant aluminum sheet that helps insulate the cool house air from hot attic air.

ALUMINUM TAPE 4" wide is wrapped around the seams to strengthen and seal the joint. Duct sections come in 4' lengths and can be cut and shaped with an ordinary knife blade.

they tend to draw off cool air, which you want, while leaving warm air trapped at the ceiling.

In a typical setup (such as Philco's), an attic installation also lets the conditioner double as an exhaust fan, drawing off hot attic air before it has a chance to heat the rooms below. A separate fan in the unit does this, pulling fresh air into the attic through another louver at the opposite end of the house. The fan can be used independently of the cooling unit or turned on a short time ahead of it, as engineers advise, to lessen the load on the conditioner.

Whichever installation you make, you'll need a three-wire, 220-volt cable to power the unit. Many communities require that such wiring be put in by a licensed electrician.

Even at that, you'll be able to put in a complete home air-conditioning system for the price of a couple of window units. And just think—you can put away your screens forever and leave your storm windows on all year round. END

Room Conditioners Do New Tricks, Too

THIS year's crop of room air conditioners will be slimmer, slicker, more versatile and easier to install.

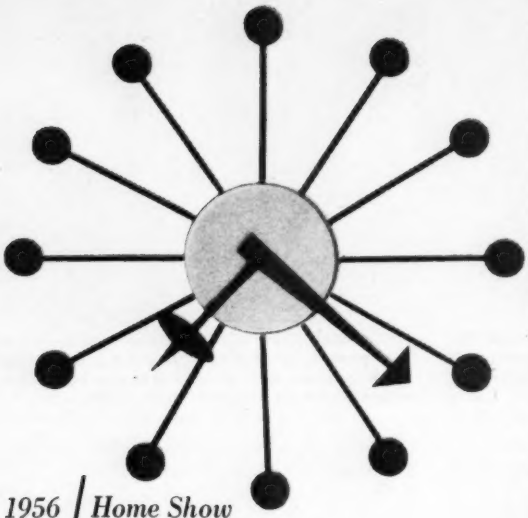
On most smaller models, you won't have to stand the cost of a special electrical circuit. These '56 units draw less current than an electric toaster and can be plugged into existing outlets in most homes without overloading the circuit.

You won't have to give up half a window for a big, bulky box that pokes into the room and steals light and view. Slim units, mounted right in the wall, sit inconspicuously flush with the inside surface and project a few inches outside.

They will be prettier, too. Many now come attractively finished in colors to match your room decorations. One unit (Cory) has a removable plastic cover plate that can be painted or wallpapered and put on in the winter. Flush-mounted units can be hidden behind drapes.

They will do more jobs. At least two lines of conditioners (Westinghouse and Emerson) have electrostatic cleaning devices that remove smoke, pollen and dust from the air. Another make (Amana) uses a charcoal filter to trap odors and fumes.

Several double-duty units circulate cool air in summer and warm air in winter. Most air conditioners you will be able to install and forget—thermostats now work with timer controls to make your cooling system as automatic and attention-free as your heating system.



1956 / Home Show

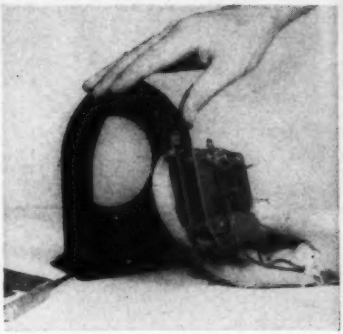
Modern Clock *for your wall is old clockworks dressed up with scraps of wood and tin.*

A TIN CAN, some minor doodads and an old clockworks can be made into one of those swank, wall clocks that sell for up to $30. Even if you buy a new clock mechanism, the job should cost you only a few dollars.

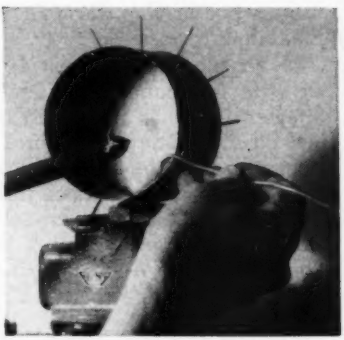
Most clockworks fit nicely inside a one-pound coffee can. Drill a ¼″ hole in the bottom for the shaft and mount the motor inside with small stove bolts. If you use a spring-wind clock, no power cord will show.

Twelve arms, tipped with 1″ cork balls, mark the hour positions. The balls are sold at hobby and fishing-tackle shops; they often come with ⅛″ holes in them. If not, drill the balls to fit on the ⅛″ dowels that are used as arms.

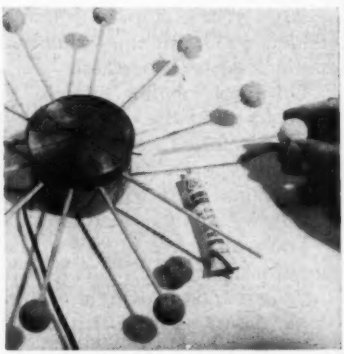
Cut the hands from tin or 1/16″ balsa wood. The hands are 4¾″ and 6″ long. Remove the old hands and solder or cement the new ones on top, then replace. We painted hands and arms black, housing gold.—*Ron Anderson, Minneapolis.*



TWENTY-YEAR-OLD RELIC provided a motor for the modern clock at left. You can usually bend the mounting brackets so that they bolt from the side of the can, instead of through the face.



INSERT SMALL NAILS, with points out, through holes drilled at 12 equal intervals, 1″ back from the face. Solder the nail heads inside the can. Attach a metal angle at top to hang clock.



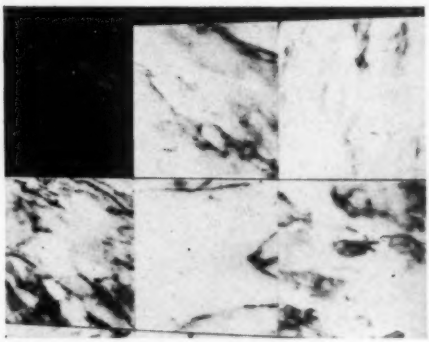
BALLS OF CORK are cemented on ⅛″ dowels, each 5″ long. Clip the nails short that stick out of the can and cement them into snug-fitting holes drilled in the other ends of the dowels.

New for the Handy Man

1. Metal Trim Snaps on Doorway. It takes only a few minutes to snap the spring metal above into a kerfed jamb and get a finished doorway like that shown at left. Tin snips are all you need to cut the material. It was specially designed for wallboard walls but can be used on other kinds, too. The surface is already primed for painting. Similar trim comes for use on picture windows.

3. Wood Veneer Comes in Rolls. Exposed plywood edges can be covered with this 1″-wide veneer, flexible enough to be bent around fairly sharp corners. You just press it on after applying contact cement or wood glue to the edge and to the latex-impregnated paper backing of the veneer. The material comes in 8′ lengths, in five standard finishes.

2. Low-Cost Marble Tiles. Marble now comes in a less-expensive, easier-to-use form: ½″-thick tiles. Intended for walls and floors, the tiles are set in adhesive over plaster, plywood or concrete. They are made in several colors and three sizes: 8″ by 8″, 12″ by 12″, and 8″ by 12″.



Further information on the products shown on this page can be obtained from: 1. U.S. Gypsum Co., 300 W. Adams St., Chicago 6; 2. Vermont Marble Co., Proctor, Vt.; 3. U.S. Plywood Corp., 55 West 44th St., New York City 36.

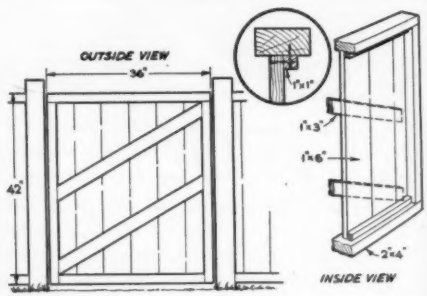
A Gate

should swing right into the design of your house. Here are five concepts.

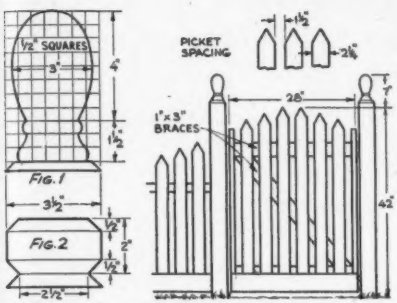
THE best-looking gates are blood relatives of the houses they serve. A rustic style looks ill at ease in front of a colonial home and a prim, white picket gate appears self-conscious before a rambling, modern ranch house.

Here are designs for five gates —at home in city, suburb or country—that you can make inexpensively with nothing more than a hammer, saw and drill. One of them should match your house. An afternoon is all it takes.

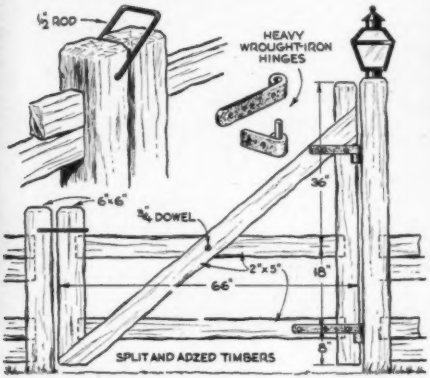
SHIP'S WHEEL adds a nautical touch to any seaside bungalow. Lacking the real thing, scrollsaw the wheel in segments and mount it atop an ordinary picket gate. The spoke ends can be cheap screwdrivers with shanks shortened, sharpened and stuck into holes in the wheel rim.



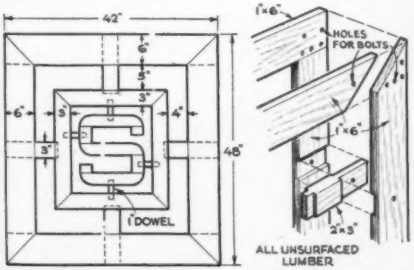
FRAMED BOARDS give privacy to a house in town. Use two-by-fours for framing, and brace with diagonal cleats. The cleats add to appearance as well as strength. This gate, a simple hammer-and-nails job, screens a breezeway.



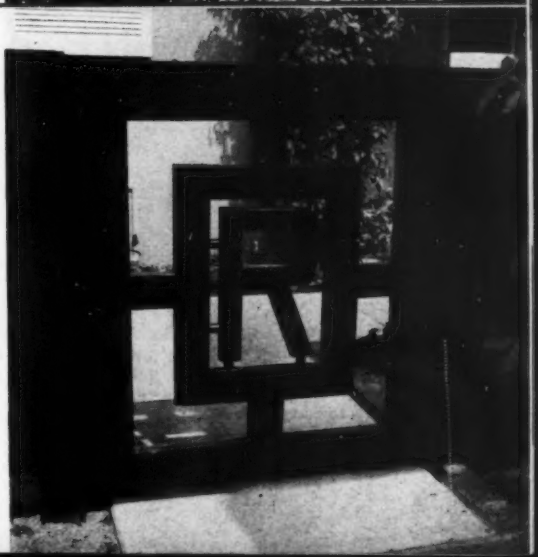
PICKETS AND CAPE COD COTTAGES are old friends. The finials on these gate posts were lathe-turned, but you could hand-saw simpler ones, as shown in the drawing. Notice how the outline of the gate pickets slopes into the fence.



SPLIT-RAIL GATE matches a ranch-style fence and house. Rough timbers were hewn by hand with an adze to heighten the rustic effect. The gate is hung on heavy, wrought-iron hinges and latched with a loop of bar iron.



INITIAL in a gate and fence of plain boards fancies up a simple masonry house. Straight lengths of two-by-three screwed together make the letter. Dowels connect letter to inner frame, which is supported by short mortised pieces.



1 MARK A TRUE VERTICAL with level or chalk line—walls are seldom plumb. Starting point, usually a corner, is the middle of an unbroken wall here, to center the big plaid pattern.

2 ANY STRAIGHTEDGE serves for tearing paper. Allow 6" of waste on each strip, matching strips by the selvage marks or pattern. Tear several at a time—pros do all of them at once.

Wallpapering Tips *show you how to turn out top-quality work—just like the pros—without fuss, lumps or slanted seams.*

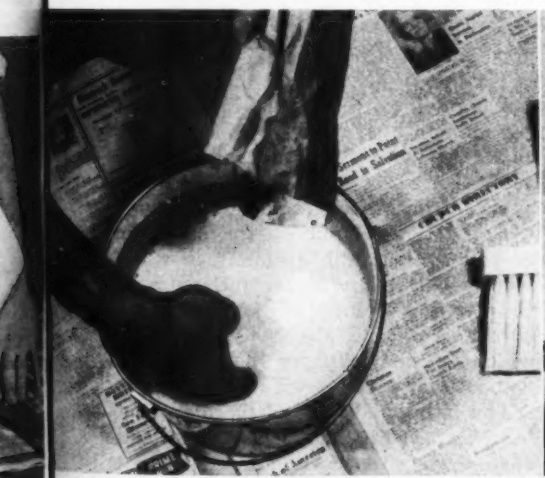
BEFORE starting to wallpaper our little girl's room, I hunted up a pro and watched him work. The tricks that I learned can help you turn in a slick job, too, next time your wife says, "Now, dear, just think what new wallpaper would do for this room!"

What you need: professional tools, by all means. It is easy and inexpensive to rent a complete paper-hanging outfit—good brushes, seam roller and the right kind of knife. Most important, you will get a pasting table. This folding gadget provides a big, handy surface for cutting paper and applying paste to it.

Buy good paste. You may want to try one of the new, slow-drying brands. They give you more time to slide paper around for a good match.

I could never get rid of the lumps in paste. My pro friend mixed by hand, literally. Stuck his hand in the bucket and squeezed the stuff smooth.

Choose wallpaper carefully. Don't give your wife free rein when you decide on color and pattern. Wallpaper with a light background and a small over-all pattern is the easiest to hang. Big, widely spaced patterns, stripes or plaids require more finesse in matching. Very dark



3 HAND MIXING, right in the bucket, is the only way to get all the lumps out of paste. Pour paste into water with one hand, mix with the other. Mix should be smooth, cream-thick.

4 LIFTING EDGE as you apply paste helps keep other sheets clean. Professionals paste up several sheets at a time. This speeds the job and gives the strips a good chance to soak.

5 FOLD OVER a piece of the top half of a strip after it has been pasted. Now shift strip around and paste bottom half, which has been overhanging the table. Fold the bottom also.

6 OPEN LONG TOP FOLD and press top edge of strip to wall. You can slide it easily into exact position. This first strip is being butted to the vertical line which was marked earlier.

7 SMOOTHING BRUSH firmly anchors top part of a strip to wall and irons out any wrinkles. Do this first, then unfold the bottom part and brush it on, too. The creases will all disappear.

background colors (such as black or deep red) show paste smears badly, and you can't help smearing some paste.

Let your wallpaper dealer trim the rolls for you, if they are not already factory-trimmed. His machine does a far more accurate job than you can do by hand. Just the same, check the trimmed rolls before you leave the store. An inexperienced clerk, or a machine that is out of whack, can cut a wavy edge that will be hard to conceal later.

Professionals trim the selvage from both edges of a roll and then butt the edges when hanging the paper. Many amateurs prefer to trim only one edge and lap over the remaining selvage when hanging the paper. Lapped seams are easier to make than butted ones; they also look a lot neater than imperfectly butted edges.

Hanging the paper. Start in the least conspicuous part of the room. When you get back to the starting point, the last sheet probably will not match up with the first one. You cannot prevent the mismatch, but you can make it happen where it won't be noticed. The side of a door is usually the best place to start. Here the mismatched seam will be very short (just the little piece that goes above the door).

Line up wallpaper with the true vertical, not with parts of the house structure. You cannot trust corners, ceilings, baseboards, window or door frames to be plumb or square. So keep the paper vertical; trim edges to fit the house.

Here's how to put up the first strip of paper on a wall, assuming that you work toward the right. Measure out from the starting point (a door frame or corner) a distance slightly less than the width of one wallpaper sheet. Make a vertical line with a level or plumb line.

The right-hand edge of the first sheet butts against this line and the left-hand edge overlaps the starting point ¼" to ½". If you started from a door frame, the overlap is trimmed to match it. If from a corner, the left-hand edge goes around the corner onto the adjoining wall. Put

up the second strip to the right of the first, and so on.

Handle the paper carefully, but don't coddle it. I was surprised by the quick, sure way the pro worked. He ripped several sheets to length at a time, tearing against a yardstick. He applied paste to several at once and folded a strip to keep it out of his way. (Creases disappear when the paper dries.) He worked the paper around on the wall to line it up, brushing and rolling vigorously.

Turning corners. The pros *never* paste a full sheet into a corner so that half of it is on one wall and half on another. Paper put up that way usually pulls loose or tears later. Here's how the pros do it:

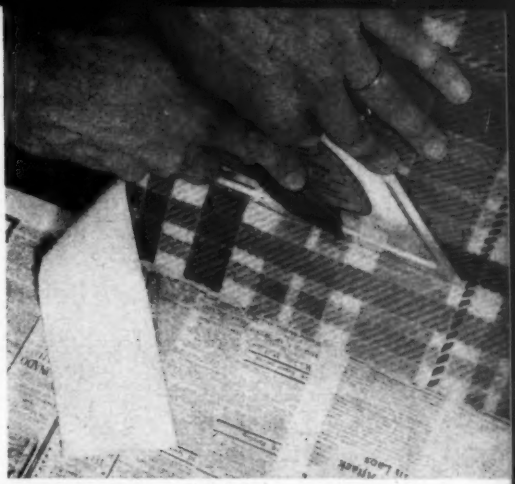
They rip the corner sheet lengthwise into two strips. The first strip is just wide enough to finish the wall that they are working on and extend about ½" onto the adjoining wall.

Since the second strip starts a new wall, plumb the right-hand edge. Trim its left-hand edge to fit the corner. Then continue as on the first wall.

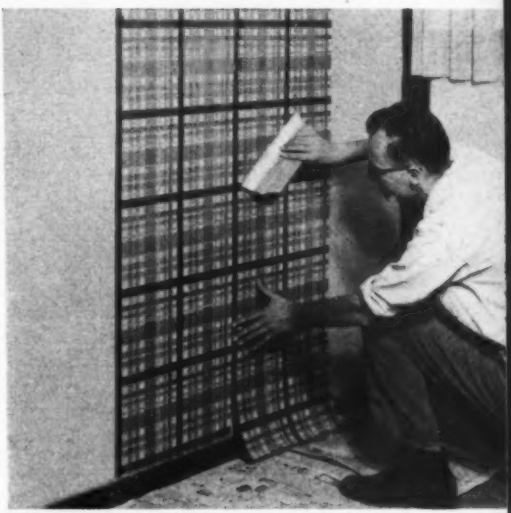
Windows. The professionals have half-a-dozen ways of papering around a window and can usually adapt one to any problem. The thing they never try is to cut a window opening out of a full sheet.

Most often, the pros tear a full sheet lengthwise into two strips, one for each side of the window. They fill in the spaces above and below the window with matching pieces cut from leftover sheets. A tip on this: You will have less trouble matching if you *don't* cut all above-the-window strips from one sheet and all below-the-window strips from another. Instead, divide one long strip so that the upper part of it fits above the window and the lower part fits below.

Work clean. Keep a pail of clean water and a sponge handy. You'll need them to wipe the seam roller, ceiling, baseboard and your hands promptly when paste gets on them. While you're sponging paste smears off newly hung paper, it's a good idea to do the whole sheet. That way the entire sheet will look the same when dry.—*Jerry Parker.*



8 SHARP KNIFE, guided by a metal straight-edge, trims top and bottom of a strip neatly. You can use scissors, cutting wheel or razor, but a knife—kept sharp—works very well.



9 SECOND STRIP is lined up with the first by matching the design. Slide the paper over for a neat seam, using the brush and your hands. Author used butted-edge seams, as pros do.

10 ROLL SEAMS after paper has been up for 20 or 30 minutes. Apply light pressure so you don't squeeze paste out through seams. Wash the roller frequently to avoid paste smears.

Flagstone Patio

is laid down quickly in sand and held together by mortar, but you never lift a trowel.

FLAGSTONES come with the mistakes already built in. They are irregular and uneven, so you can't go wrong in using them for a simple walk or terrace. And the construction job is very simple if you lay them in dry mortar: Put the flags down, sweep unmoistened mortar mix into the joints, spray with a hose. Any way you lay it, a flagstone surface may crack. But nobody will notice.

SMOOTH THE GROUND and tamp it down hard, pitching it for drainage. Spread a 2″ layer of coarse sand and level with a two-by-four. In cold climates, put cinders under the sand.

MATCH FLAGS the best you can, leaving at least a ½″ gap between them. Wiggle each stone into the sand and shove more sand under wobbly pieces. Use the two-by-four to even surfaces.

SWEEP DRY MORTAR into all the gaps between stones and brush the tops reasonably clean afterward. Use one part portland cement to two parts fine sand—plus coloring if you like.

SPRAY A FINE MIST over the whole works, saturating the mortar. Repeat this every 15 or 20 minutes for a few hours to wet it down to the sand bed. Then relax—you're finished.

Concrete Drive

puts a heavy, steel-reinforced spur of superhighway alongside your house.

By JIM MILLER

MY NEW driveway is like a spur of superhighway—heavy concrete, steel-reinforced, 5″ thick. It shouldn't crack when the fuel-oil truck rolls in. I can sweep away snow without sweeping away the drive. And there should be no upkeep. It should last until I trade my car for a helicopter.

With ready-mixed concrete, which the truck dumped and spread in the forms for me, it took less time than I expected.

Forms. I used two-by-fours. (If you intend to salvage the lumber for re-use, prime-paint it first.) A carpenter's level set the slope, which should be arranged to drain off water from rainstorms.

My garage is above street level, so I pitched the forms ⅛″ per foot lengthwise for the "flat" stretch in front of it, then more steeply to meet the street. Because the grade provides good drainage, I placed the concrete directly on the ground. If you have a drive that collects water, a 6″ base of gravel or cinders is recommended under the concrete to prevent frost-caused heaving.

To make sure of good runoff, I dished the concrete after it was poured by leveling it with a screed tapered about ½″ downward at the middle. This makes the drive a shallow trough that sluices rain right into the street. If your drive must slope down to the garage, keep the surface flat but pitch it to one side (the side away from the house).

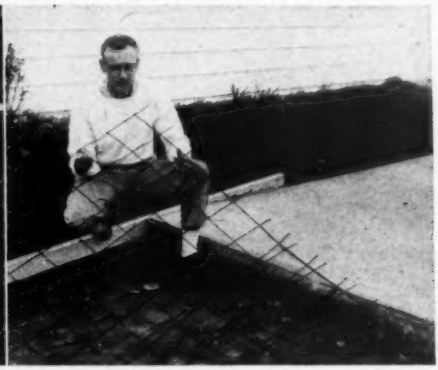
Concrete. To estimate how many cubic yards of concrete you will need, multiply the length of your drive by the width and by the depth—all in feet—and divide this figure by 27.

Building regulations where I live required 3,500-pound concrete (able to support 3,500 pounds per square foot) for the strip between my property line

DIG OUT THE BED about a foot wider than the drive will be, to make room for forms. Strings between corner stakes outline the area. Dig deep enough for the slab thickness—here 5".

TWO-BY-FOUR FORMS, staked every 4', do not reach bottom of 5"-deep bed. Depth is checked with a gauge made by nailing blocks on ends of two-by-four. It slides along the form pieces.

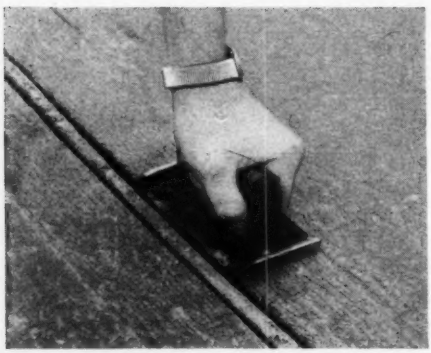
EXPANSION STRIPS of tarred felt are held in place by two-by-fours until concrete is poured. Note the heavy planks laid to support the concrete truck while it pours the first slab.



REINFORCING MESH—this is 10-gauge wire with 6" openings—keeps slab from cracking. Cut it with fence-wire clippers to fit forms with 3" gap at sides. Lay it just before pouring.

TRUCK POURS MIX a slab at a time. Helpers spread it while reinforcing mesh is pulled up every foot or two to center it in concrete. Hook, bent from ¼" steel rod, lifts the mesh.

TO LEVEL THE CONCRETE, two-by-four screed is dragged over it. Make first striking with screed held rigid, then repeat several times, vibrating it back and forth to smooth surface.



ROUNDED EDGES are put on sides and expansion joints after concrete has become firm to touch. For safe traction, surface was not troweled, but left with texture produced by striking.

and the street. Since this mix cost only a little more than lighter stuff, I used it for the entire drive.

Reinforcing. Your driveway will be much less likely to develop cracks if you embed steel mesh in the concrete. The mesh is sold by concrete dealers in sheets and rolls—the rolls are usually cheaper. I used 10-gauge mesh, light enough to be cut with fence clippers.

Cut off pieces for all the slabs, but place them in the forms one at a time, just before the concrete is poured—you don't want the truck to ride over the mesh. As the concrete is poured, be sure that you lift all of the mesh up so that it will be suspended in the middle of the slab thickness.

Expansion joints, which give each slab room to expand and contract without cracking, are made with strips of tarred felt (the concrete man sells this, too). The felt is held in place with a two-by-four, with the top edge about ½″ below the concrete surface. You need joints every 15′ to 20′.

After the slabs are poured, remove the expansion-joint two-by-fours and level the concrete right over the felt expansion strips, marking their locations first. You expose the joints later by running the edging tool along the strips.

Give your driveway plenty of time to set. The forms can be removed after 24 hours. If the weather is warm, the concrete may dry out too fast. So keep it damp for several days by sprinkling it regularly or by covering it with wet newspapers, burlap or straw. Better not drive on it for at least a week. END

Keeping the Home Shipshape

FOLDING DOORS, built from old shutters, make a handsome, more convenient entrance to your dining room. They won't obstruct furniture placed in a corner.

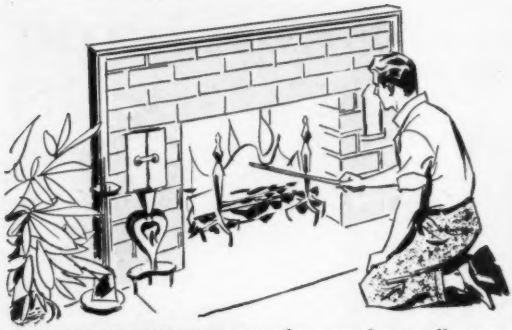
A ROLL-OUT DRAWER—a simple box on casters—keeps records under a low table. Store albums in the drawer with their backs up so that the titles will show.

TO MAKE AN OLD SINK LOOK NEW, enclose it with a woven bamboo curtain. The curtain comes ready to hook over a stock rod, which can be supported by hangers nailed to adjacent cabinets. The curtain opens for access to equipment under the sink.

QUICK AND EASY SHELVES, ideal for a recreation room, hang on plastic clothesline from hooks screwed into joists. The line is knotted beneath holes in each shelf to support the shelf and keep it level.

Please turn the page for more home tips

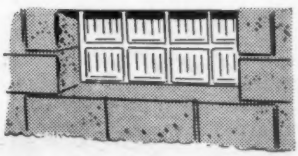
More Home Tips



AN OLD-FASHIONED FIREPLACE that crowds a small room can be scaled down by removing the slablike mantel and framing the brick with shadow-box molding.

CLOSETS JAMMED? A bedroom door that is rarely closed offers extra storage space on its back. A separately hinged shelf unit (above) can be hung there to hold ties, shoes, gloves and other small articles of clothing.

SMOOTH LIGHT FOR A SMOOTH SHAVE is provided by three fluorescent fixtures, two at the mirror sides and one on the ceiling. The overhead lamp throws light down into the washbowl where it will reflect up under your chin.



THERE'S NO FRAME to fix and paint if you replace seldom-opened cellar windows with glass bricks, as above.

A LARGE WINDOW in an old-fashioned bathroom goes modern when you fit it with shutters of perforated aluminum The perforations admit light yet obscure the view, eliminating the need for curtains or shades.

YOU CAN SAVE TOUCHING-UP by using tinted putty to make minor repairs on your windows. Save a little of the trim paint that you used on your house, and mix some in with putty as you need it.

Dripless Paint *looks like jelly, but liquefies as you brush it. You don't need a dropcloth because you just can't spill it!*

By DARRELL HUFF

SEVEN-YEAR-OLD Laurie was just putting the last brush strokes on our living-room wall when our next-door neighbor, Mrs. S, stopped in. Before she could even say hello, she spotted Laurie and gasped:

"You're not letting that *infant* paint! And without any what-d'-ya-call-it—dropcloth—or anything!"

I couldn't resist the temptation. I gently upset the can of paint six inches from her obviously new suede pumps.

Mrs. S let out a shriek and did a broad jump to equal anything in the Olympics. Not a drop of paint flowed out of the can.

That's dripless paint. It just won't

HERE'S PROOF that you can paint without dropcloths, even kick over the pail without spilling. Dripless paint remains firm in can and on brush, turns to liquid when you spread it.

WORKING OVERHEAD is no problem for even this seven-year-old. Dripless paint won't spatter or run down her arm. The brush won't "load" and leak no matter how long she keeps working.

PAINT CLINGS TO BRUSH, allowing you to cover larger areas with fewer time-outs for refilling. Brush is pulled straight from can with no stopping to scrape off the excess on the side.

budge. You really have to work to get it to drop, droop, splash or run. A thick, fluffy, jelly-like substance, it won't spatter when you put it on, won't flick off a brush or roller, and won't run down your arm.

No preparation or cleanup. Dripless painting becomes quick and casual, instead of a major undertaking. You can paint whenever you have a few minutes to spare because there's no time wasted in arranging dropcloths or cleaning up stray spots later.

You don't have to mix the paint, either, any more than you would homogenized milk—and for the same reason. The pigment, held in the jelly-like mass, always remains evenly distributed throughout the entire can.

To start, you just remove the lid, dip in your brush, and paint.

How it works. What keeps the paint from dripping is a special "thixotropic" vehicle, called Burnok, made from plastic resins.

Thixotropic means jelly-like. This jelly breaks down quickly under motion. In the can and on the brush it remains firm. But spread it on a wall and the friction turns it into a thin liquid that smooths out evenly over the surface.

It paints better, too. Because the no-drip paint returns to a jelled state as soon as you put it on, there are no runs and sags. On vertical surfaces, especially, these can ruin an entire job.

More paint clings to the brush, so that you get more strokes to the brush-load without stooping and dipping as often. It also seems to go farther (600 to 650 square feet per gallon, claims the manufacturer) and to have better hiding power, making it the nearest thing to a true one-coat paint.

The jellied vehicle can be used to make various alkyd, oil and varnish types of paint, of which flat wall paints are the most popular. These wall types are now being sold by a number of manufacturers, including the pioneer, Superior Paint and Varnish Corp. of Chicago, as well as such mail-order houses as Sears, Roebuck and Montgomery Ward.

Color mixing is easy. Dripless paints (sometimes called jell, gel, anti-drip, no-drip or controlled-flow) come in the same wide assortment of colors as standard paints. But you're not limited to these stock hues alone. You can intermix the colors, if you use the same type of paint.

You just dump the two colors together

[Continued on page 270]

New Ideas from the Inventors

1 Floatable House to Ride Floods. Large air tanks, normally recessed into cellar space, would serve to float this house over the crest of a flood. Vertical rails—spring-mounted to allow some sway—would join the building to the foundation and guide it back into place again after the water had receded.

2 Match Cover to Strike a Light. When released by a thumb button, springs in this matchbook holder would open the cover and lift and strike the first match. After each used match was torn out, the wire lift arm would hook under the next match on the card.

3 Handle to Hold File Flat. You could keep the full cutting face of a file flat against the work if it had a handle like this attached to it. Grippers at one end would engage slots in the tang; a screw-tightened foot at the other end would lock the arched holder firmly to the file.

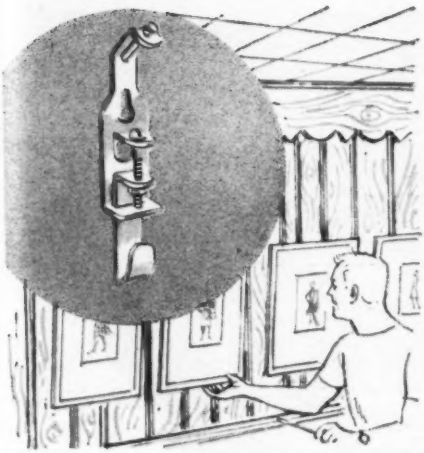
Please turn the page for more new ideas

More New Ideas from the Inventors

4 Window Flaps to Keep Cellar Dry. Slanting rain would be less likely to find its way into your basement if you added these extensions to awning-type windows. The flaps could be screwed to wooden windows or attached to metal frames by flanges and springs.

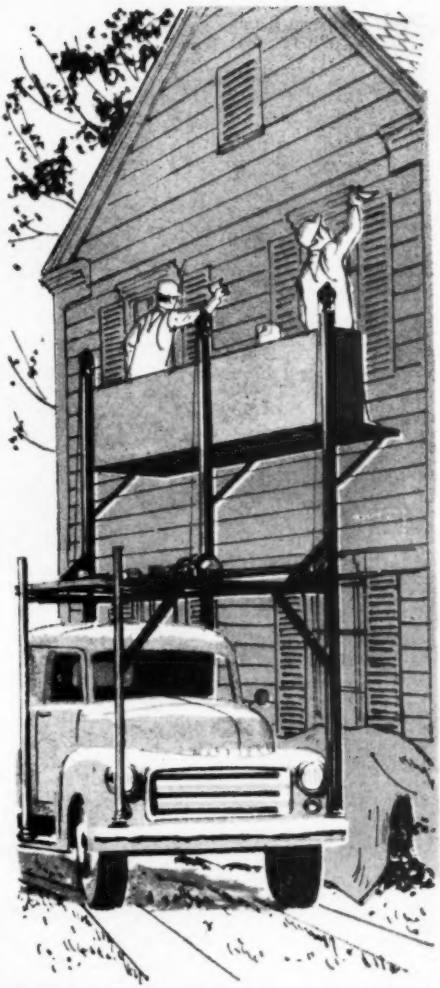
5 Dimmer Pedal to Signal Turns. One bar switch that could be levered right or left to blink a car's turn signals, or pushed straight down to dim the headlights, might simplify auto wiring. In clutchless cars the pedal could be placed within easy reach of the left foot.

7 Paper Shields to Keep Off Rain. Patrons wouldn't be left stranded by sudden rains if stores or theaters provided throw-away cardboard umbrellas. Arm straps attached to these waterproof disks would permit them to be worn. The cheaply made rain shields could be given away or sold in public places.



6 Hook to Adjust Picture Height. With this adjustable hanger you could quickly straighten a picture or line up several in exactly even rows. The top and bottom of the hanger would be separated and a screw would be turned to raise or lower the picture's position.

8 Net to Catch Rejected Toys. Babies have a way of throwing their playthings out of reach and then crying until somebody comes along to pick up the toys and return them. With this play-pen net catching an infant's wild pitches, a mother could go on with her work instead of acting as a retriever.



9 Scaffold to Ride to Job. Attached to a frame mounted on a car or truck, this mobile work platform could be set up faster than ladders on most jobs. An electric motor would crank the scaffold up and down as needed. For road travel the vertical support rails would be retracted and the platform removed or folded against the frame on the truck.

U.S. patents on these inventions have been granted to: 1. Richard Carver, Cleveland; 2. Charles Soule, Reno, Nev.; 3. Gabriel Domonkos, Detroit; 4. Glenn and Betty Scott, Miami; 5. Thyra Howard, Detroit; 6. Joseph Pfankuch, Menominee, Mich.; 7. Edgar Jones, Indianapolis; 8. Norman Le Roy, Miami; 9. Arthur and Vern Solomon, Seattle, Wash.

New for Boatmen

1. Fishtails Afloat. Now they're making dream boats that look like dream cars. Sports-car designer Brooks Stevens dreamed up this $11,000 Evinrude Lark, the most expensive outboard runabout ever built. The 16-footer has Cadillac fins, bucket seats, auto-type dash and lots of dazzling chrome.

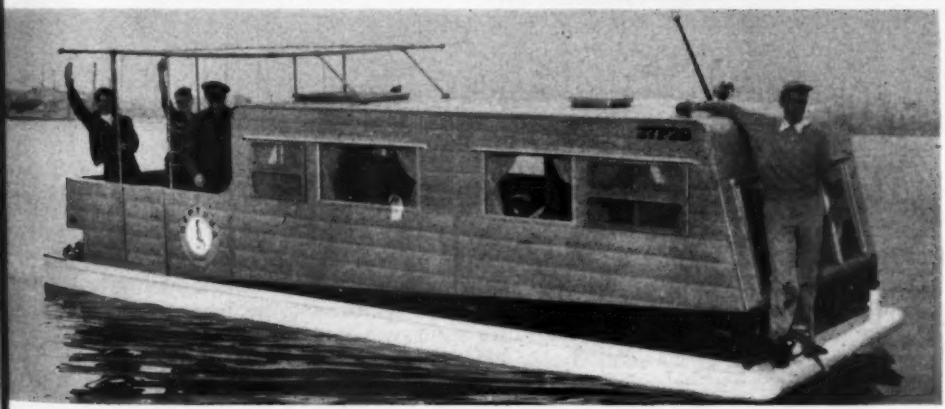
2. Inboard-Outboard "Aquaplane." Made of glass-fiber-reinforced plastic, this skimmer is powered by its own outboard. The motor, available in seven to 20 hp. is forward for better stability. Hand ropes steer the craft through a rudder at the stern; if you let go of the ropes, the motor stops.

3. TV for Small Craft. Boat owners may be taking their TV sets cruising with them, now that a full range of converters and filters is available for marine use.

They supply the right kind of current and squelch interference from generators, motors and electronic gear that spoils good pictures.

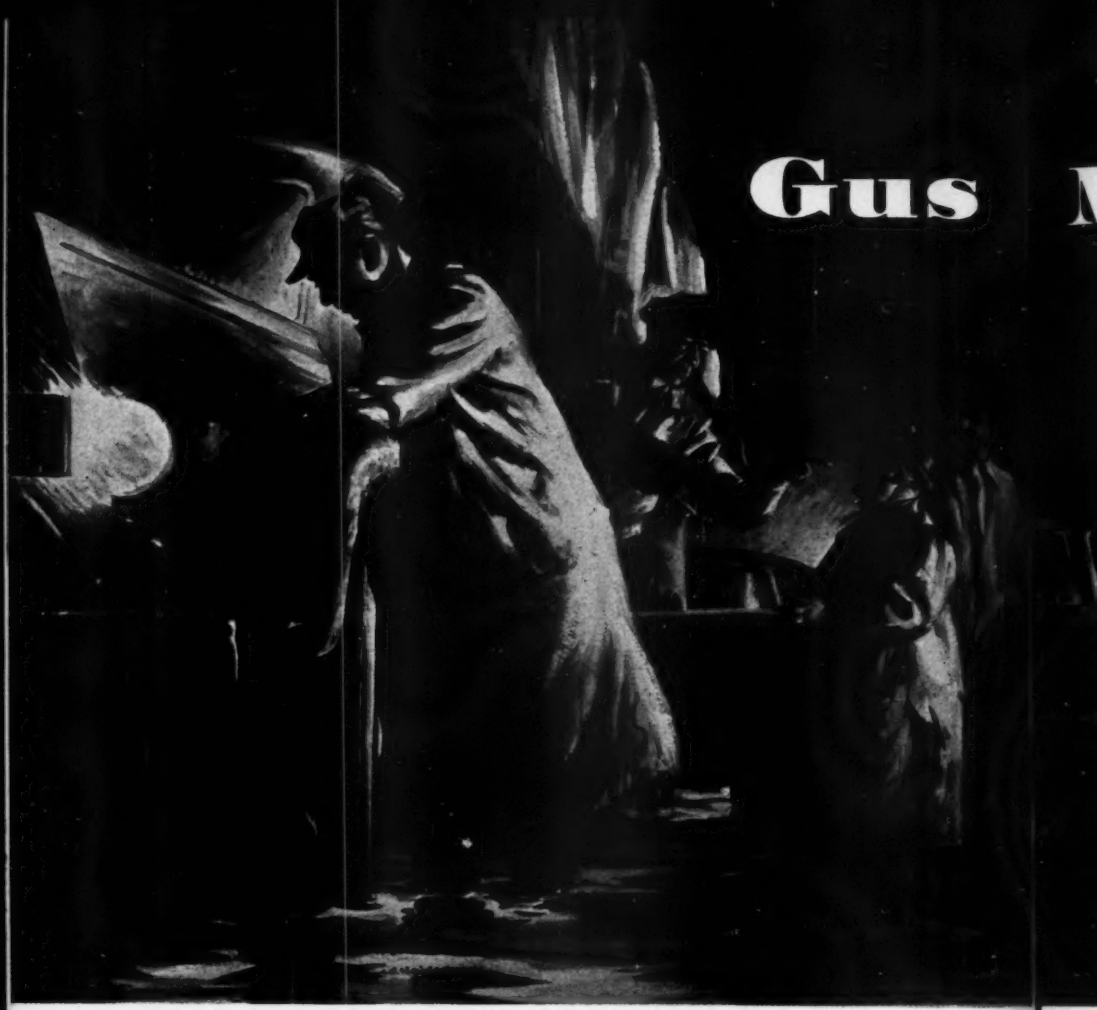
4. Seagoing Volkswagen. An industrial version of the four-cylinder, air-cooled engine that powers VW cars drives this 18-foot Olympia. The 36-hp. motor pushes the boat along at 18 m.p.h. and uses 1½ gallons of gas per hour. The engine and exhaust system are separately cooled by air ducts having intakes inside the boat.

5. Transparent Pram. You can see right through this eight-foot plastic boat. Its one-piece, 44-pound hull will carry three people and can be driven by a small outboard motor. The transparent plastic is leakproof and requires no maintenance. The boat is 45 inches wide and has mahogany gunwales and seats.



6. Houseboat-Trailer Combo. This land and water cruiser is a houseboat with wheels—or a trailer that floats. Ashore, a car tows the 26-foot boat on two retractable wheels. Afloat, an outboard motor pushes it. Inside the steel hull are bunks for four, a lavatory and a kitchen with sink, stove and icebox.

Further information on the products described on these pages can be obtained from: 1. Evinrude Motors, Milwaukee, Wis.; 2. Luria-Cournand, Inc., Havre de Grace, Md.; 3. Cornell-Dubilier Electric Corp., South Plainfield, N. J.; 4. U-Mak-It Products, 701 Whittier St., Bronx 59, N. Y.; 5. Sudbury Laboratory, South Sudbury, Mass.; 6. Neptuna Corp., 1127 Wilshire Blvd., Los Angeles 17.



Gus

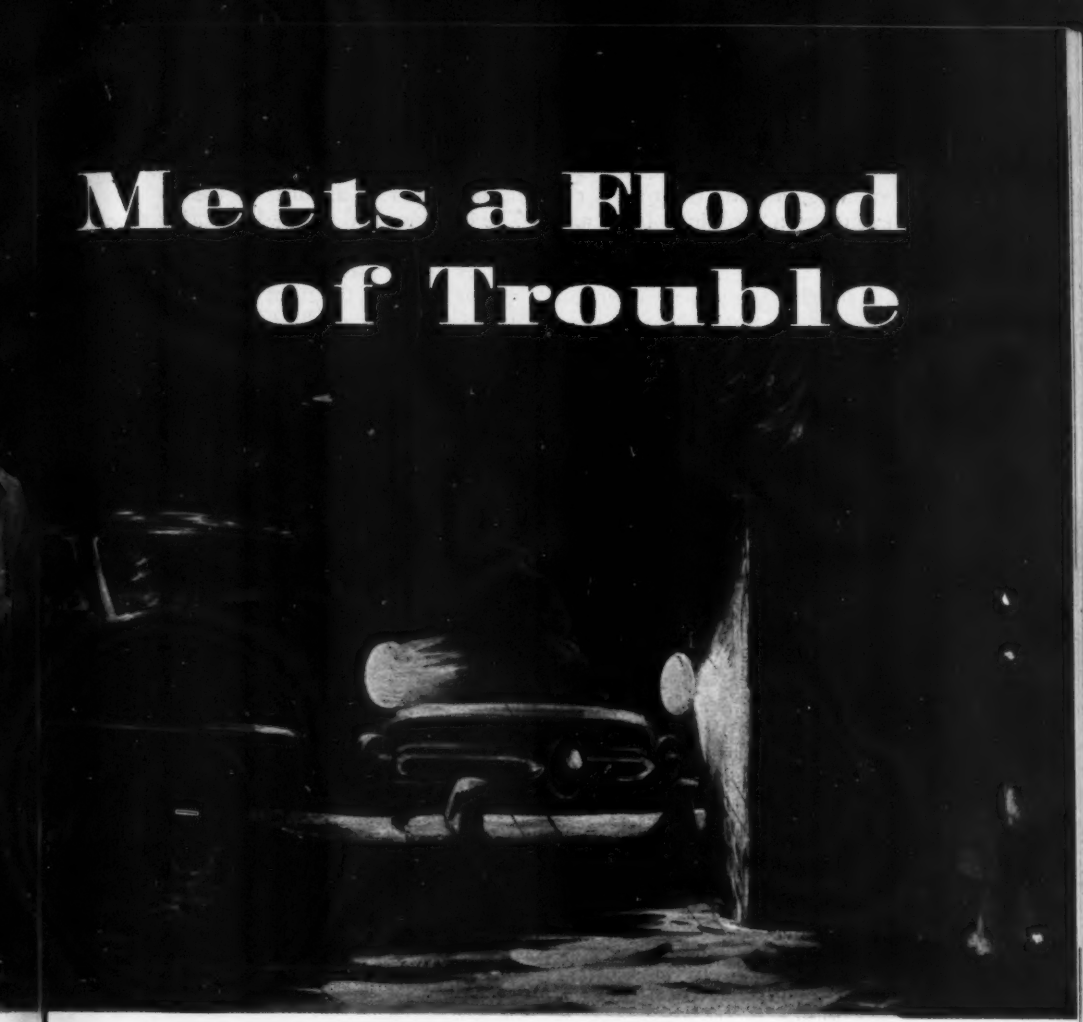
Most guys in a spot are glad of a little

By Martin Bunn

GUS WILSON, burly proprietor of the Model Garage, was driving back to town after spending Sunday in the country with friends. It was a wild night, with a torrent of rain lashing the windshield. As Gus's car nosed down into the concrete-walled underpass beneath the railroad tracks, the green sedan in front of him suddenly flared its stop lights, slewed crazily and shuddered to a halt crosswise of the highway.

Gus tapped his brakes off and on to avoid a spin, had a moment of horror when he glanced into his rear-view mirror and saw headlights bearing down on him from the rear. Coming to an instantaneous decision, Gus swung his wheel over hard toward the graveled shoulder and the concrete wall beyond it. It took delicate timing to swing the wheel back at exactly the right moment, tramp his brakes to slew the rear of his vehicle around, release brakes and shoot down into the underpass, barely missing the

Meets a Flood of Trouble



help—but this trucker was a queer one.

halted sedan. As Gus's car rode into the underpass a wall of water sprang up over his windshield, completely obscuring his vision. He brought the car to a halt and leaped out, flashlight in hand.

To his astonishment he found himself standing in a foot of water. His involuntary grunt of distaste turned to an exclamation of horror as his flash beam pierced the darkness. Something had evidently clogged the drain of the underpass. The concrete bowl was filling with water to create a trap in which several cars were stalled. Gus began running back, waving his flashlight in warning to any cars that might be approaching.

As Gus came to the green sedan he saw that the car that had been behind his had also managed to miss the stalled vehicle by turning its nose over the shoulder. Even as he recognized the car as Pete Vancourt's, Pete sprang out.

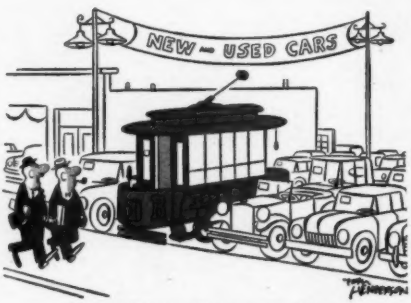
"Gus Wilson!" he exclaimed. "That was a narrow squeak."

"Sure was, Pete," Gus said crisply. "Here comes another car. Better try to

stop it. The underpass is full of water and stalled cars."

"Good Lord!" Pete exclaimed, and then he was running towards the tunnel entrance, swinging a flashlight back and forth to wave down the oncoming car.

GUS was running the other way, intent on warning cars that might be coming out from town. As he went under the shelter of the underpass the downpour of rain went away but the water at its deepest part rose above his knees. Cars shooting into this at high speed had driven such waves of water over the windshields that startled drivers had clamped on the brakes and slewed in all directions. Undoubtedly some motors had also been drowned out. Arriving at the opposite end of the underpass, Gus was relieved to see that some quick-thinking citizen was there before him, halting the cars that were coming from town.



"Lots of these places are making fantastic trade-in deals."

A quick inspection of the underpass drain grate showed Gus that it wasn't clogged where he could clear it. Intent on clearing the highway jam, he got tools, a tire pump, a dry cloth, and a tow cable from his car.

The underpass was a bedlam of sound, magnified to a fearsome bellow by the tunnel. Timid drivers were leaning on their horns and yelling at one another, while the more energetic were wading about in the knee-deep water trying to do what they could. It was a miracle that there had been no serious wrecks or injuries.

The first vehicle in line was a truck with a fully enclosed van body. This truck had managed to ride through the deluge before drowning out. It had swerved obliquely across the highway with its hood thrust out in the downpour. The next two cars, a Ford and a Chrysler, had managed to miss crashing into it, but just barely. The Ford had its front bumper against the left wall of the underpass, its rear against the truck's side. The Chrysler had skidded the other way, ramming its snout under the rear of the truck's body, and laid its rear bumper within inches of the right wall. The three vehicles formed a solid barricade behind which several cars were stalled.

Gus took in the situation at a glance. The truck was the key vehicle. Nothing could move until it moved. It couldn't be towed by one of the cars on the town side of the underpass, due to its oblique and car-locked position. It would have to inch around on its own power. A group had gathered about the truck, offering assorted advice to the driver, who was grinding on the starter.

"Need any help here?" Gus inquired. "Better take that battery slow."

The driver, a lanky individual whom Gus had never seen before, climbed down and thrust his light in Gus's face.

"I've had all the advice from you yokels that I want," he said harshly. "How about standing clear and minding your own business?"

"WHY, you durn fool—" Gus recognized Tom Hanratty's exasperated voice—"that's Gus Wilson you're talking to, mister."

"I don't give a hoot who it is," the driver snapped. "Clear out, all of you. I've started stalled trucks before."

"Yeah," a sarcastic voice called from the group, "and then we'll stay stalled here all night. Come on, men, let's shove the front end of this rig around."

"Get away from my truck," the driver yelled, and his face held an ugly look.

Gus doubted that the group could

[*Continued on page 244*]

How to Make Archery Safe

This booming sport is lots of fun. Here are pointers on how to make harmless blunt-nose arrows.

By Andrew Pfeiffer

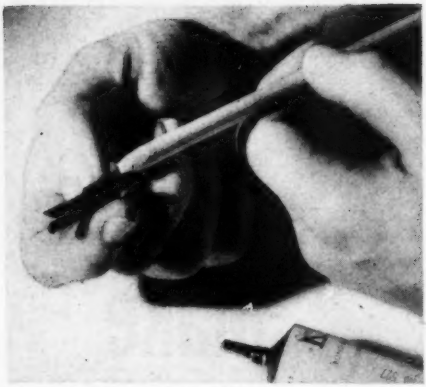
IF ROBIN HOOD could step out of the TV tube now, he would find about 500,000 organized archers and about as many more casual ones zinging arrows at targets and game. Archery is the fastest-growing sport in the country, says the National Sporting Goods Dealers Association.

Last year one large manufacturer sold $1,500,000 worth of archery equipment. This was more than double the company's sales figure for 1952.

Hunting with bow and arrow follows the same upward trend. Over 123,000 licenses were issued in 1954, as against the 93,000 that were registered during the year before, according to the National Field Archery Association.

There's much more to archery than just the romance of Robin Hood. The biggest kick comes from watching an arrow fly to its mark, from the instant it leaves the bowstring until it chunks into the target.

Next to that is the fun of making the tackle. It doesn't usually pay to make a bow, but you can turn out the arrows, a quiver, an armguard and shooting gloves yourself. Each of them is a workshop project that will bring you a lot of satisfaction and, incidentally, some sub-



TO MAKE AN ARROW, first cement a nock on one end of a bare shaft. It fits the bowstring when you shoot. A pencil sharpener will taper the shaft to start, but finish it with a knife.

stantial savings over ready-made gear.

A good way to get started in this exciting sport is to make a dozen or so of the special blunt-tipped arrows described here. They're safe even for the kids to shoot and seldom break or get lost because they can't dig into anything. With reasonable care you can turn out arrows every bit as handsome and accurate as the best ready-mades—for about one-third the cost.

Three simple jigs speed the work and ensure uniformity. One holds all three feathers against the shaft simultaneously for gluing. A second shapes the feathers and a third steadies the shaft while you paint on cresting.

From your local archery dealer or a mail-order supplier* you will need:

- 1 doz. $\frac{5}{16}$" nocks (notched devices that fit the bowstring).
- 1 doz. $\frac{5}{16}$" Port Orford cedar shafts.
- 1 doz. right-wing feathers, black.
- 2 doz. right-wing feathers, red.

A $\frac{5}{16}$" arrow shaft can safely be used with bows having a pull of under 45 lb. For heavier bows, order $\frac{11}{32}$" shafts and nocks. All wing feathers should come from the same side of the bird so that the arrow will rotate properly in flight.

Fit a nock to the shaft. Taper one end of the shaft with a sharp knife until you can twist the nock on snug and true. Cellulose (household) cement will hold it permanently. After the cement has set, give the shaft a protective coat of lacquer.

Feather the arrow by inserting the nocked end of a shaft in the base of the feathering jig. A rib on the nock fits into the notch provided. Cut one black and two red feathers to about 5" length and put them in the clamps. (The black cock feather lines up with the rib on the nock.)

Apply a heavy layer of household cement to the quill-edge of each feather and slide the clamps into the jig. A rubber band twisted around the tops of the clamps will hold feathers and shaft tightly together. Allow about 20 minutes for the cement to dry.

Shape the feathers. You can streamline feathers quickly and uniformly with the hot-wire feather trimmer. Plug in the trimmer and wait until the wire becomes red hot. Now insert a feathered shaft in the holder and rotate it counterclockwise. As the wire touches a feather it will burn through, leaving a smooth edge.

Finish feathering by paring down the quill where it's cemented to the arrow shaft. The quill should blend into the shaft so that a sharp edge won't cut your hand when you shoot.

The hot wire used in this jig is cut from a 600-watt heater element wired into the circuit. *Any other kind of wire is dangerous.* Remove the screw on the side of the heater element base and unwind about 20 spirals of wire. Cut this loose end off, smooth it out and shape it to the outline of a feather. Don't forget to reconnect the heater element wire or you will have an open circuit.

Crest the shaft. The bright bands on an arrow shaft are like the owner's name. An archer who takes pride in his tackle gives careful thought to a distinctive combination of wide and narrow bands.

Multi-colored decoration also makes an arrow stand out better when it lands in the underbrush. You won't lose as many.

Your cresting kit should include two or three bottles of lacquer (various colors) plus a narrow and a wide paintbrush. With a feathered shaft in the cresting

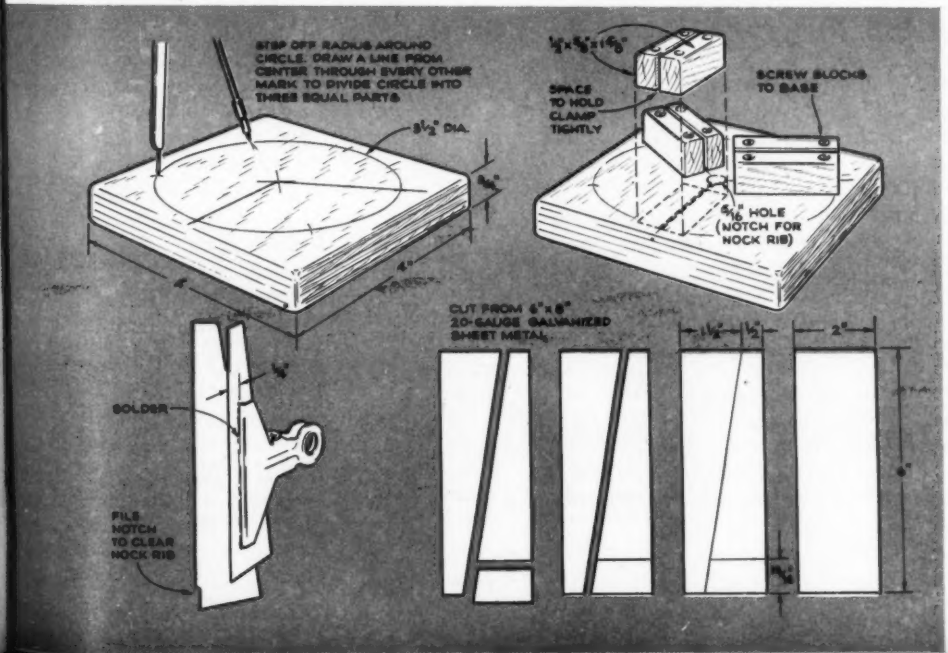
**The materials that I used came from Pride Archery Co., RFD No. 1, Danbury, Conn.*

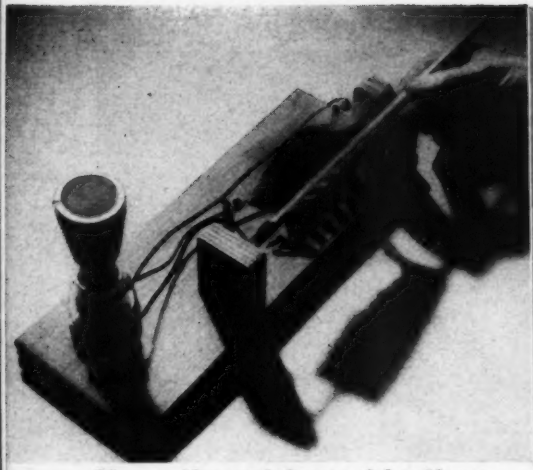
How to make and use a simple, three-way feathering jig

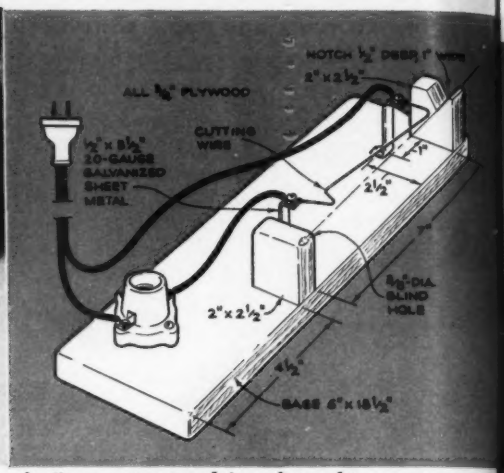
THREE FEATHERS AT ONCE are cemented to an arrow shaft in the second step. The jig's wood base holds a shaft and three metal clamps.

Grip a 5" length of feather in a clamp so that the barbs slope toward the nock. Coat the quill with cement and slide into place.

To make the base, drill a hole through the center of a square block and mount three pairs of blocks to it. The blocks straddle guide lines 120° apart. Draw them with a protractor or use a compass to locate points on a circle (as in sketch). Notch the center hole to admit the rib on the nock and shim the six small blocks with paper to square them with the base. Heavy paper clamps are soldered to extensions of 20-gauge galvanized sheet metal.


STEP OFF RADIUS AROUND CIRCLE. DRAW A LINE FROM CENTER THROUGH EVERY OTHER MARK TO DIVIDE CIRCLE INTO THREE EQUAL PARTS.
8½" DIA.
SPACE TO HOLD CLAMP TIGHTLY
SCREW BLOCKS TO BASE
5/16" HOLE (NOTCH FOR NOCK RIB)
CUT FROM 6"x8" 20-GAUGE GALVANIZED SHEET METAL
SOLDER
FILE NOTCH TO CLEAR NOCK RIB
2"





Shape the untrimmed feathers

A HOT-WIRE JIG burns the feathers into shape for flight. Perform this third step by slowly rotating the arrow counterclockwise. To make the jig, mount a porcelain socket and two scrap-metal strips on a base. Wire as shown. Screw a 600-watt heater element into the socket and connect a piece of wire taken from this element, properly shaped, to the metal strips.

jig, hold a brush against the shaft with one hand while you rotate the arrow away from you with the other. I also paint my shafts between the feathers and up to the edge of the nock.

Make the tip. Carve a blunt arrowhead from a block of hardwood. (Or use 1″-diameter birch dowel if wood carving is not one of your specialties.) Drill a $\frac{5}{16}$″ hole about an inch into the tip—the shaft fits in here. A dummy shaft slipped into this hole will give you a handhold for carving. It can be chucked in an electric drill or lathe so that you can turn the tip instead of handcarving it.

Cut the shaft to length. The unfinished shafts come about 30″ long and will have to be cut to size. Find the proper length by slipping a tip on a shaft temporarily and fitting the arrow to your bowstring. With the arrow pulled back at full draw there should be about ½″ between the narrow end of the tip and the bow.

Cut the shaft to proper length and glue the head on with household cement. A coat of clear lacquer will protect the tip or you can decorate it with color.

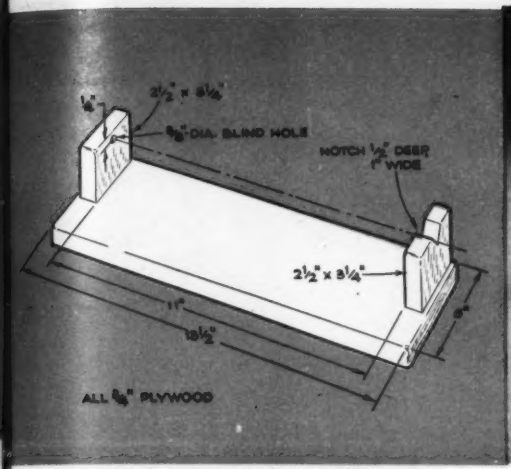
A quiverful of these blunt-tipped arrows, a bow and a target backstopped by straw or heavy cardboard will get you started in archery. The youngsters are in for some exciting times too, but you'd better keep an eye on them. Even though these arrows are considered safer than the sharp-ended ones, it's still best to be alert when someone's shooting.

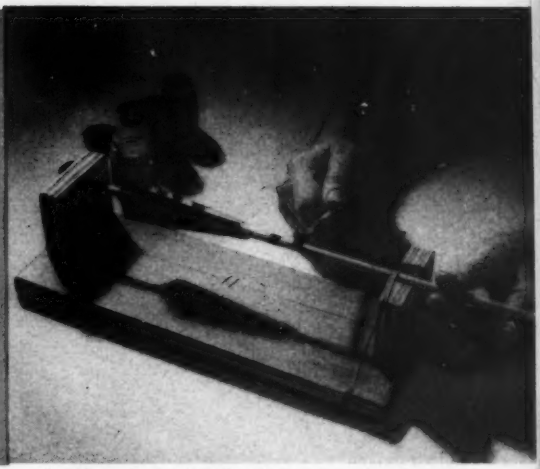
Scoring is a bit of a problem with blunt-nosed arrows, since they bounce off (which saves wear and tear on your target). But you can get around this by rubbing the tip in carpenter's chalk or cue chalk. Use a different color for each archer.

Shooting is most fun (because it's most accurate) when your bow has just the right pull. The ancient Arabs devised a method for finding their best pull that's still used.

Run some line through a shoulder-high pulley. Tie a small loop in the top end of the rope and fasten a 20-to-25 lb. weight on the lower end. Grasp the loop with three fingers, as you would a bow string, and lean against the pulley support as though it were a bow. Add or subtract weight until the pull feels about right as you draw the loop to the side of your chin in a simulated shot.

This table will give a rough check





Brand your arrow with paint

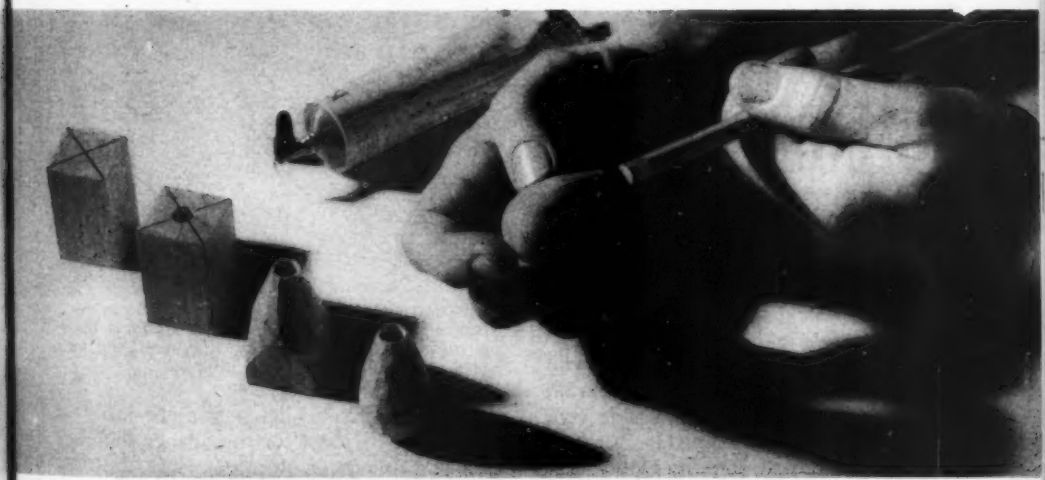
A CRESTING JIG helps put on varicolored stripes in the fourth step of preparing your arrow. Paint the identifying stripes with lacquer by holding a brush and turning the shaft away from you. Several colors and brush widths add variety to your special crest marking. Simplest of all the jigs to make, this one uses a 60° countersunk hole in the left upright block to hold the nock.

for younger bowmen. Remember that the pulls given are only averages and do not apply to all individuals.

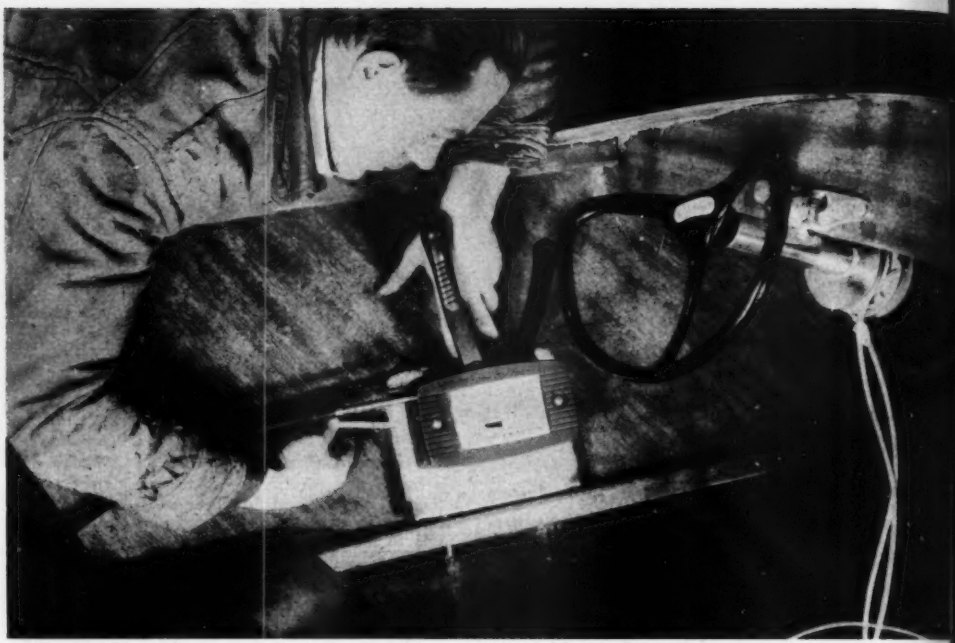
8-10 years old	15 lb.
10-12 years old	15-20 lb.
12-14 years old	20-25 lb.
14-16 years old	25-30 lb.

When in doubt it's better to use a lighter bow than a heavier one. A bow that's too heavy won't shoot as straight and it could get out of hand.

In buying bows it's a good idea to make your first one relatively inexpensive. You can swap it for a better one with more pull, after your skill and shooting muscles have developed. END



FINISH UP WITH A BLUNT TIP for the business end. Carved or turned from a hardwood block or length of birch dowel, its rounded end can't dig in. Protect it with lacquer. The blocks are 1" square by 1¾" long and have a 5/16" hole drilled an inch into end that fits over shaft.



CABLE STEERING. Plane-type wheel operates this Scott-Atwater steering rig, a drum with plastic-coated cable running through pulleys. One lever shifts gears, other controls the throttle.

Remote Controls For Your Outboard Motor

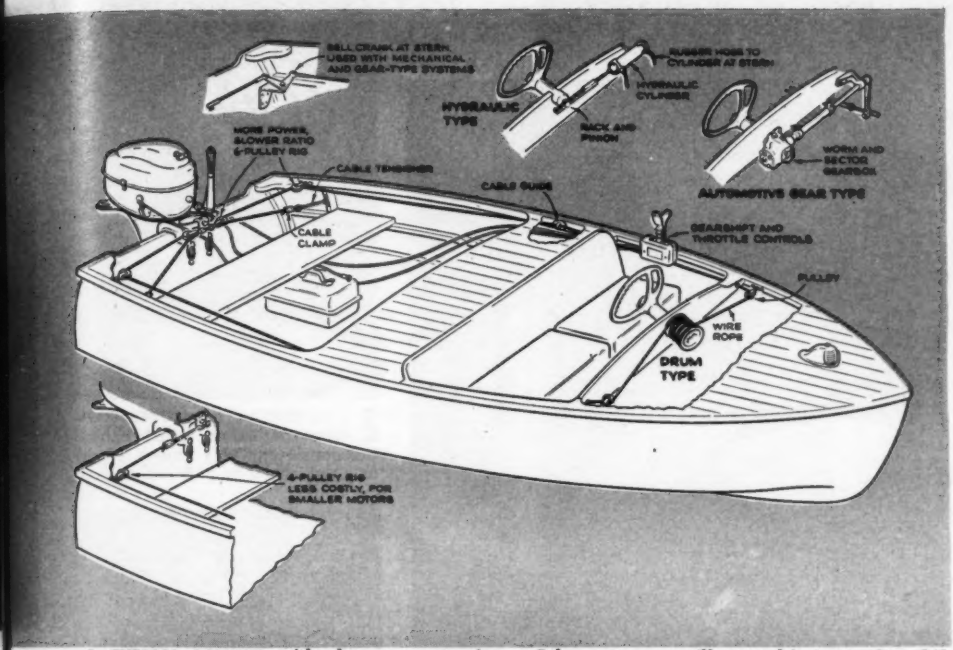
AUTOMOTIVE STEERING. A steering system recently introduced by Gemmer in kit form has a worm-and-sector gear with a pitman arm to push and pull a mechanical linkage.

WHY crouch in the stern with your outboard motor this summer? You can move forward and run the boat as easily as a car by installing remote-steering and engine controls.

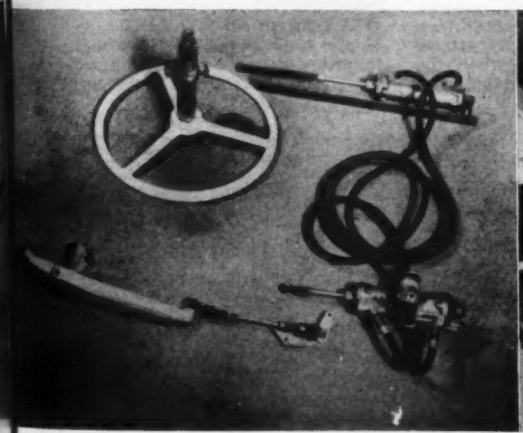
For the maximum in convenience you need an electric-starting button nearby, gearshift and throttle levers beside you, and a steering wheel ahead. But you can settle for remote steering alone.

Drum-and-cable steering is the least expensive and most widely used. But you can also buy hydraulic or straight mechanical rigs. Except for the fittings that connect cable to motor, gearshift and throttle controls are all basically alike.

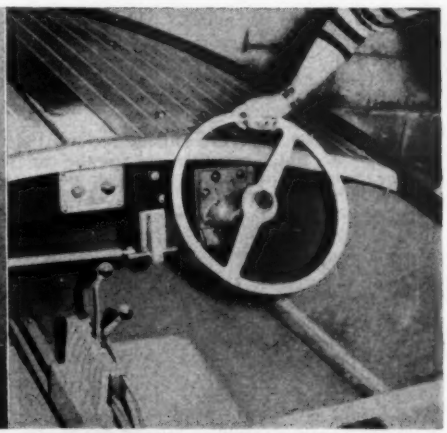
Steering controls can be selected on a



A TYPICAL LAYOUT with drum-type steering through cables and pulleys is shown above. Other systems are illustrated in insets. Gearshift and throttle controls have flexible cables.



HYDRAULIC-STEERING KIT by Duotrol includes wheel, rack-and-pinion-operated piston in a power cylinder, rubber hose, slave cylinder for mounting at the stern and a bell crank with arm.

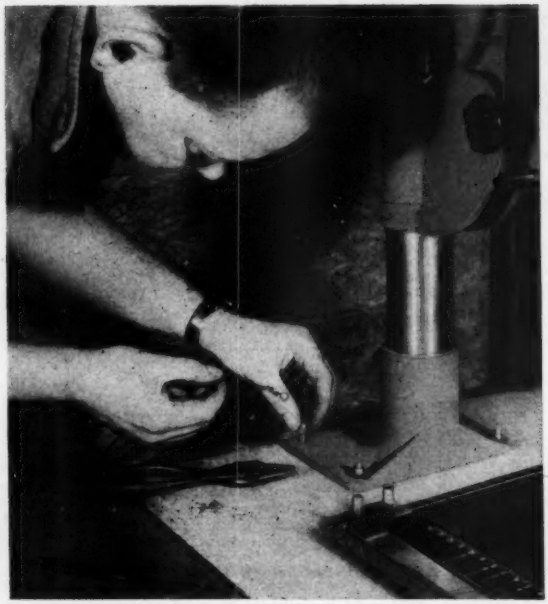


RACK-AND-PINION STEERING with Robart rig is all-mechanical through push-pull links and bell cranks. Note special bracket on inner keel for mounting gearshift and throttle controls.

price basis, but consideration should also be given to safety and the type of boating that you do. Four-pulley rigs for small motors and low speeds, can be treacherous with big motors and fast boats that should have a six-pulley system. END

Further information about the products mentioned here can be obtained from: Gemmer Mfg. Co., 6400 Mt. Elliot, Detroit; Robart, 3010 N. 90 St., Milwaukee; Scott-Atwater, Minneapolis 13; Duotrol, Fox River Sales, Oshkosh, Wis.

5 Photo Tips



1 GROUNDING AN ENLARGER by running a wire to a water pipe may lessen the number of dust specks on enlargements. A soft brush will remove most of the dust from a negative, but brushing generates static electricity, attracting more dust. The charge will be dissipated when you insert the metal neg carrier into the grounded enlarger.

2 A CORRECTLY DEVELOPED COMPARISON PRINT taped behind the developing tray makes it easy to judge when to pull out a print.

3 A POINTER cut from black tape and stuck to the edge of a dial thermometer enables you to spot the 68° position in the darkroom.

4 FOR A HUGE BLOWUP without racking the lamphouse to the ceiling or putting the easel on the floor, slip a closeup lens over the enlarging lens. This reduces the focal length.

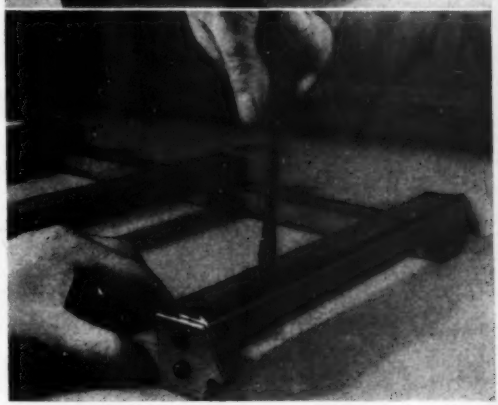
5 NEED A SET OF AMBER BOTTLES for storing solutions? Ask your druggist to save the bottles that medicines come in, preferably those with plastic screw caps. Snip labels from photochemical cans. Roughen the label back and glass with a piece of abrasive cloth, and stick to the glass with cellulose or acrylic cement.

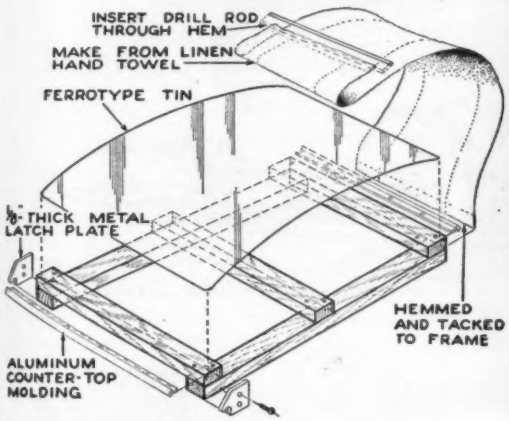
Oven Rack Dries Prints Fast

IF YOU'VE been yearning for a fast-working photoprint dryer, look in the kitchen. The oven in the range will dry glossies on ferrotype tins in eight to 10 minutes.

You need a rig to hold prints flat on the tin until they dry. This one is a wood frame (see sketch below), ¼" shorter than the tin to make the tin bow up. The tin is held on each end in the lip of a kitchen-counter molding (below right). A linen apron, cut from an old dish towel, stretches taut over the prints.

Before squeegeeing prints on the tins, soak them in a flattening solution (4 oz. glycerin to 28 oz. water). Set the oven for low heat.

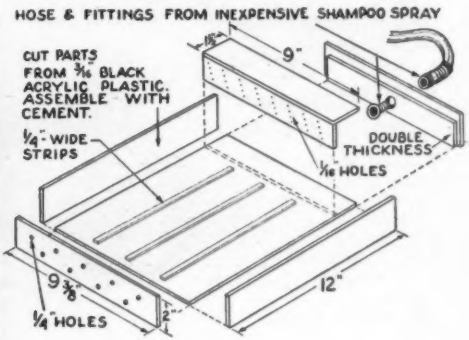



INSERT DRILL ROD THROUGH HEM
MAKE FROM LINEN HAND TOWEL
FERROTYPE TIN
⅛" THICK METAL LATCH PLATE
HEMMED AND TACKED TO FRAME
ALUMINUM COUNTER-TOP MOLDING

Homemade Plastic Tray Washes Prints Thoroughly in Water Spray

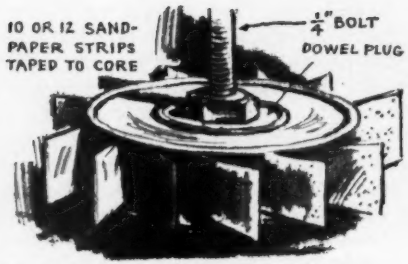
THIS homemade tray does an efficient job of washing prints at the kitchen sink. It sends a riffling stream of water squirting in one end and out through holes at the other end.

The tray is cemented together from pieces of $\frac{3}{16}$" or ¼" acrylic plastic. Water enters by a hose borrowed from a shampoo sprayer and jets onto the prints through $\frac{1}{16}$" holes drilled in a baffle. The outlet end has ¼" holes drilled in it. Strips cemented to the tray bottom allow water to circulate beneath the bottom print.—*John Burroughs, Tacoma, Wash.*



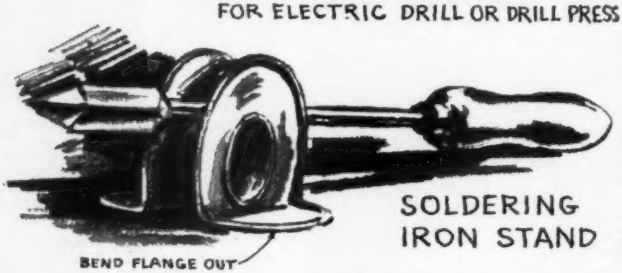
8 USES FOR Adhesive Tape Spools

STAMP CONTAINER



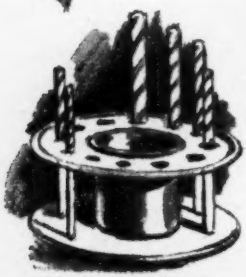
FLEXIBLE STRIP SANDER
FOR ELECTRIC DRILL OR DRILL PRESS

PLUMB
LINE
REEL



SOLDERING
IRON STAND

TOWEL-ROD BRACKETS

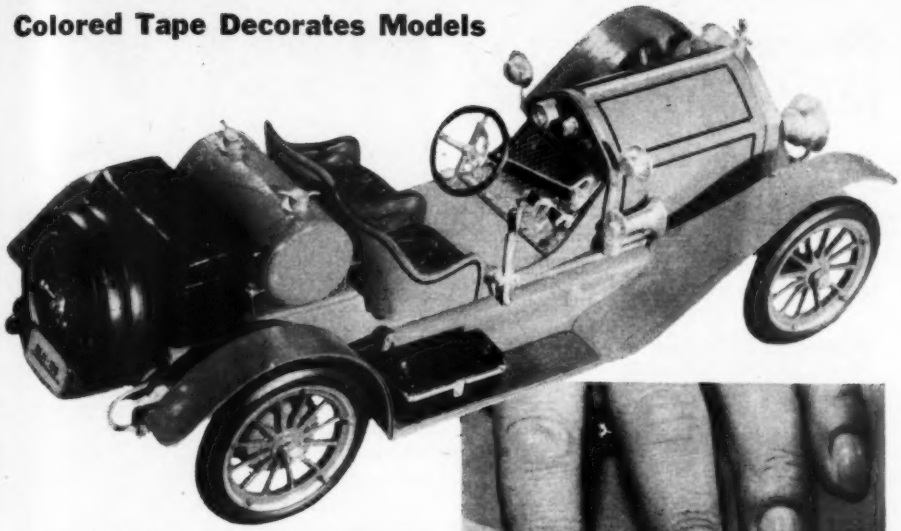


DRILL STAND

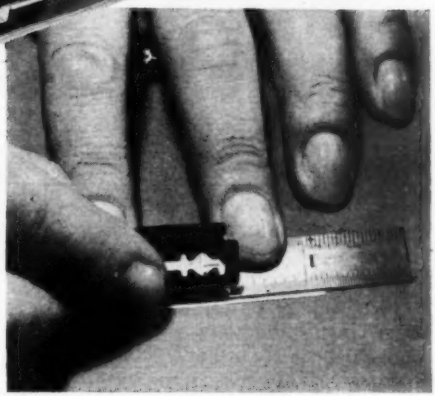
PINCUSHION

SINGING TOP

Colored Tape Decorates Models



THIN striping on models, such as that on the hood and seats of the car in the photo, is hard to paint evenly unless you are an expert. One way to put it on is with colored adhesive tape. Cut the tape with a razor blade on a nonsticking surface, such as glass or wax paper, using a ruler for a guide. After applying, finish it off with a coat of clear dope.



Magnet Holds Chalk to Board

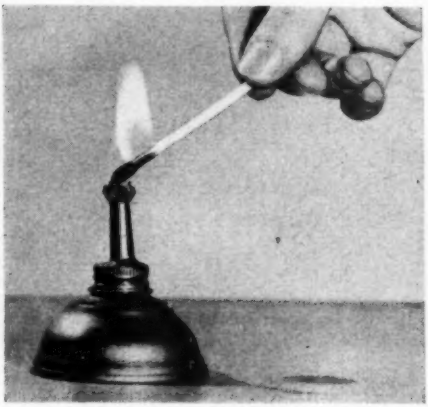
BY CEMENTING a small magnet on a piece of chalk, you can hold the chalk to a shuffleboard scoreboard or other metal surface. Cut a flat side on one end of the chalk as a surface for the magnet.

Cone Slump-Tests Concrete

TO TEST a batch of concrete, fill a 12″ cone and invert it on the ground. If it sags more than 3″, engineers say that the mix is too moist for average use.

Oil Can Puts Heat on Small Jobs

AN INEXPENSIVE oil can fitted with a wick makes a handy alcohol lamp (below) for heating solder, bending glass and other small jobs. Hacksaw the spout to a stub and insert a round wick in it.

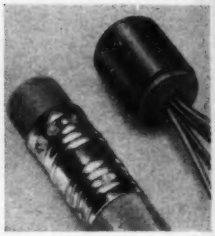


New in Electronics

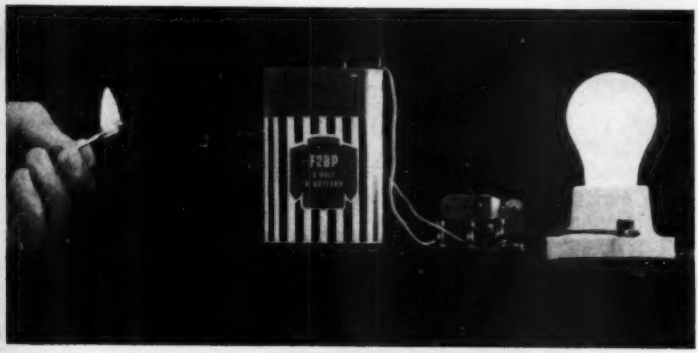
1. Test Your Hi-Fi Ear. You discover what notes you can hear at what volume with this audiometer, installed in a "hi-fi salon." You put on the earphones and turn the pitch and volume controls to test your ears at various frequencies.

2. Wrist Radio. The Dick Tracy job above covers the broadcast band without an antenna in areas of moderate signal strength. It uses printed circuits throughout, three transistors, five button-size mercury batteries, and a hearing-aid earphone. Small and light (2½ ounces with batteries), the receiver has a two-stage transformer-coupled audio amplifier and a whistle-free regenerative circuit.

3. Transformers Go Miniature. Hardly bigger than an eraser, this miniature transformer for transistor circuits is said to be more efficient than ordinary types.



4. Radio Pager. The pocket receiver at left, an all-transistor set, buzzes when the wearer is called and then relays a message to him, privately. It is designed to pick up signals from an inductive antenna loop circling the building in which it is being used.



5. Transistor Eye. A new light-sensitive transistor is 10,000 times as responsive as ordinary photoelectric cells and can generate 100 times as much current. In the demonstration at left, light from a match makes the transistor trigger a standard relay—without any amplifier—and turn on the bulb.

Further information on the products above can be obtained from: 1. Federated Purchaser, 1021 U. S. Route 22, Mountainside, N. J.; 2. LEL Inc., 380 Oak St., Copiague, N. Y.; 3. United Transformer, 150 Varick St., New York City; 4. Motorola Communications and Electronics, 4545 W. Augusta Blvd., Chicago; 5. Westinghouse Research Labs, Pittsburgh, Pa.

How to Use Abrasive Wheels Safely

By Harry Walton

BOTH ordinary grinding wheels and abrasive cutoff wheels rate a place in the craftsman's shop. The first, properly mounted on a bench grinder, AC motor, or combination power tool, will sharpen edges, clean up castings, smooth welds, and grind off rivets.

With the thinner cutoff wheels on a radial-arm or portable electric saw, you can slice through almost anything from steel to ceramic tile or concrete blocks.

Like anything run under power, abrasive wheels demand respect. Properly used, they are among the safest of tools. Mismanaged, they can be as unfriendly as a burst of shrapnel. In industry, the dangers are known and safeguards are enforced. But in the home shop the hazards may be unsuspected.

Flying sparks are an obvious one, easily guarded against. Simply make it a rule to wear goggles any time and every time you turn on an abrasive wheel. In

What makes a grinder safe

some modern factories nobody is allowed even to walk through the plant without wearing eye protection.

Danger you can't see. Modern abrasive wheels have come a long way from what were called "widow makers" in the old-time cutlery plants. But no wheel yet made is unbreakable—and that includes so-called flexible wheels, despite brand names and advertising that would seem to label them almost indestructible.

There is no advance notice when a spinning disk of abrasive builds up to a smashing climax. The difference between incident and accident then depends on such details as goggles, guards, and safe working habits. Industry takes these seriously. So should you.

The American Standards Safety Code for abrasive wheels, though written for industrial users, applies equally to the wheel you mount on a wood lathe, the grinder you make from a washing-machine motor, and the cutoff wheel you use to cut patio blocks. Follow this code, and the chances are that you'll never break a wheel—but will be safe even if you do.

Why do they break? The reasons why wheels shatter boil down to three:

- Excessive speed.
- Faulty mounting.
- Improper use.

Right on the blotters—paper disks on each side of a wheel—you'll find its *maximum* speed rating. The wheel has been tested at considerably above this speed running free, but hard grinding creates heat, which joins centrifugal force in trying to tear it apart. So run a wheel not at, but well below its marked speed.

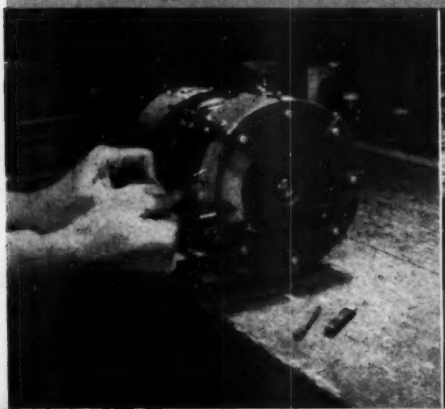
A split-phase motor (the kind you might salvage from a refrigerator or washing machine) should have its r.p.m. rating on the plate (usually 1,750).

When such a motor drives a grinding

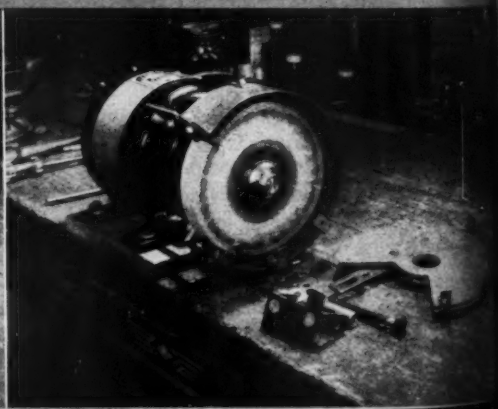
CHECK YOUR GRINDING SETUP against this well-designed bench grinder. It has big flanges, a guard that surrounds the wheel 270°, end covers, and spark shields. A slotted tongue (arrow) can be lowered as the wheel wears to a smaller diameter, maintaining full protection.

How to convert an old AC motor into a safe tool sharpener

ADD A GUARD to a motor salvaged from a washing machine or refrigerator, and you have a useful grinder. The grinding rest is mounted on two slotted supports bolted to the end covers.



TAP HOLES in band-iron rim for screws that hold end-cover brackets. To change wheels, remove rim screws from the four upper brackets, side screws in cover from three lower ones.



Mount abrasive wheels properly

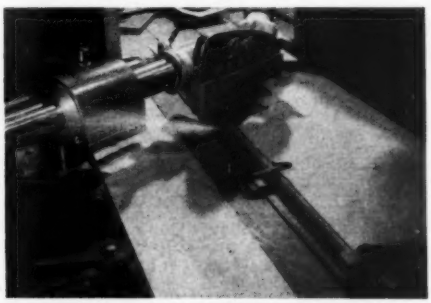
CHECK ARBOR SPEED against wheel speed on blotter. Tap wheel with a piece of wood; if it does not ring clearly, it may be cracked. See that blotters are larger than flanges, and not damaged. Remove inboard flange, if detachable, to clean it and shaft shoulder it bears against. Replace flange with recessed face out. See that wheel fits freely (never force it on) and put on the outer flange, recessed face toward the wheel. Tighten the nut enough to prevent slippage, but not excessively. Adjust the grinding rest 1/16" to ⅛" from wheel face. Turn wheel by hand to make sure it runs true and clears rest and guard. Standing out of line with the wheel, turn it on. Let wheel run a full minute before using it.

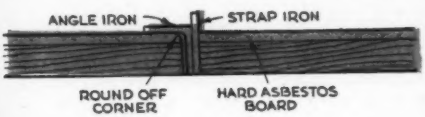
head by means of a belt, a little math will give you the wheel speed. Multiply motor speed by its pulley diameter, and divide the product by the diameter of the driven pulley. (For example, a 3" pulley on a 1,750-r.p.m. motor gives a product of 5,250. With a 1½" grinding-head pulley, dividing 5,250 by 1½ gives a shaft or wheel speed of 3,500 r.p.m.)

V-belt pulleys should be measured on their pitch diameter—the circle on which the center of the belt runs. This isn't easy to do. And strangely enough, a belt-drive ratio can change with time, because the small pulley wears faster than the big one. For these reasons, the only sure way

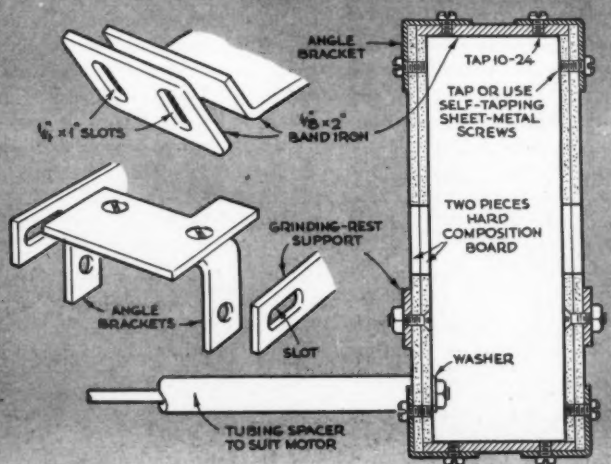
A radial-arm saw works well with an abrasive cutoff wheel

IT'S A NATURAL for cutoff jobs because the work can be held firmly, straight wheel feed is assured, and the exposed part turns away from the user. Keep others from behind the machine. As metal may turn red hot at the cut, asbestos table covering and metal fence are desirable. To cut tubing, clamp it under a notched block so that it cannot roll, as at extreme right in photo.

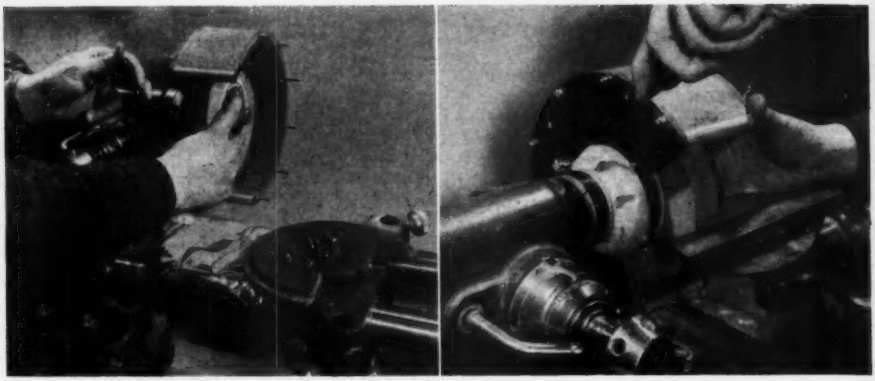


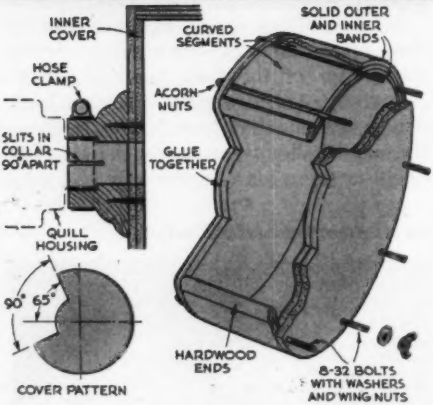


BEND THE RIM no more than 1" larger in diameter than wheel to be used. Turn top end up 90° to hold the adjustable tongue. Guard must be firmly attached to withstand shock if a wheel should break. Replace the motor bolts with long rods threaded at both ends, using spacers to set the guard off so that the wheel will be centered. Better still, anchor the guard to the bench top with lag screws through the bottom of the iron rim.



A grinding guard for a wood lathe or combination tool





SAFE TOOL GRINDING is possible with this guard made of hard composition board. End covers consist of two ¼" thicknesses each. Soak three ⅛" strips in hot water and bend them around a form. Cut the middle strip into segments. Glue these between the other layers, with 3½" threaded rods between segments. To align rods with cover holes, assemble rim and covers, with wax paper in joints, while glue is soft. Tighten nuts on rods and let glue harden. Turn inside of maple collar to fit the quill housing, outside to suit an aircraft-type hose clamp. Wheel is left inside the guard and the whole rig mounted as a unit, the arbor setscrew being tightened through a hole in the collar as above. Outer cover is removed only to change the wheel. Adjust guard for no more than 65° exposure above the centerline. Kitchen foil used on the tool ways protects them from grinding dust.

to check a worn drive is with a tachometer, or with a rev counter and a watch.

Think a few hundred r.p.m.'s won't matter much? They do. Centrifugal force goes up as the square of the velocity. A wheel safe at 3,500 r.p.m. will be stressed *twice as much* at 5,000 r.p.m.

How about universal motors? You won't find any speed rating on vacuum-cleaner, mixer and similar universal motors—the kind that have two removable carbon brushes and are labeled AC-DC. Running without a load, these can go fast enough to tear the leads off their own commutators—or rip a grinding wheel to fragments.

Rheostats and governors reduce the torque of such motors as well as their speed. Belting them down to drive an abrasive-wheel arbor at a lower speed is safe only if you can accurately measure the top speed of the driven shaft, and may prove unsatisfactory because it will slow down rapidly under load.

Square holes on square shafts. The hole in an abrasive wheel should be a close yet easy fit on the arbor. If it must be wrung or forced on, fracture stresses may be set up around the hole, which is the weak spot in any wheel.

A sloppy fit makes for eccentric running, which is also bad. Bushings are available to make larger holes fit ½", ⅝" or ¾" shafts. On portable electric tools with square shafts, use wheels with matching holes.

Who's got the flanges? The ASA code is specific about the flanges that clamp the wheel on its arbor. Among other things, it says that they should

be one third to one half the diameter of the wheel itself, both the same diameter, recessed on the wheel side and machined smooth, and that the inboard or driving flange should be keyed fast.

The average arbor or grinding head will fall down on two counts. The flanges will be too small for the 6″ wheel you'll probably want to mount, and the inner flange will not be keyed, but loose against a shoulder on the shaft.

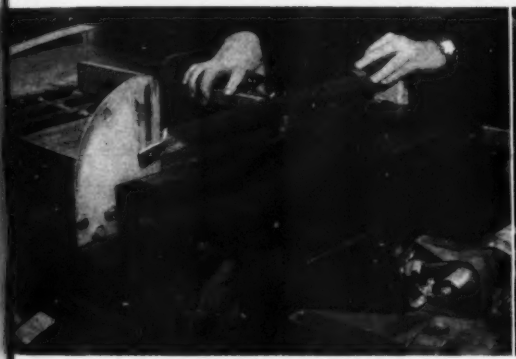
Until machine manufacturers wake up to code requirements, there isn't much you can do about either of these shortcomings. You can, of course, refuse to buy a grinder with 6″ wheels held by

[*Continued on page 254*]

Use cup wheel for side grinding

NEVER GRIND HARD or apply heavy pressure on the side of a straight wheel. The right kind for such work is a cup wheel, designed to stand side stress. Here it's being used to sharpen a big drill. The drill jig shown automatically assures getting all the various drill angles right.

How to reduce the hazards of abrasive cutting on a circular saw



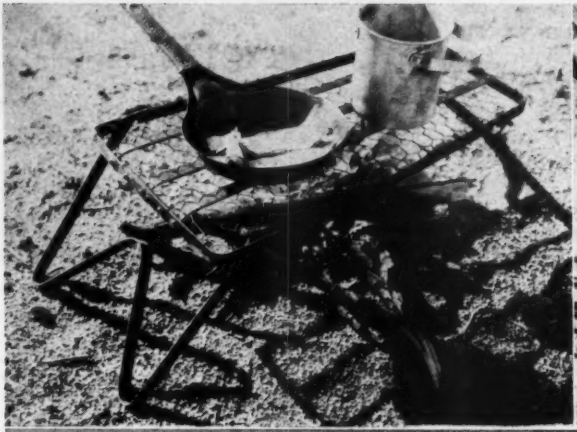
A WHEEL-HUGGING DEFLECTOR like this is safer than most saw guards. Hacksaw the piece of angle, pinch it around the splitter, and drill for a bolt. Slit corner at other end, bend 90° and bolt to a forked wooden support clamped to the front table edge as in the next photo.

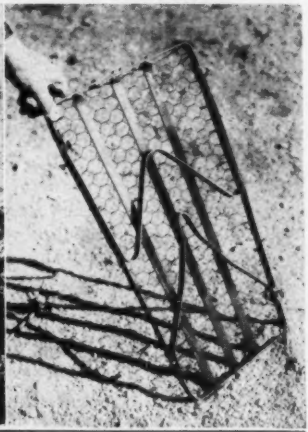
CUTTING CERAMIC TILE is easy. A slotted piece of wood is clamped under the deflector at the back of the saw table, with a shim the thickness of the tile under it. Always clamp cutoff work to the miter gauge or butt it against a stop block so clamped, as above, to prevent side movement.

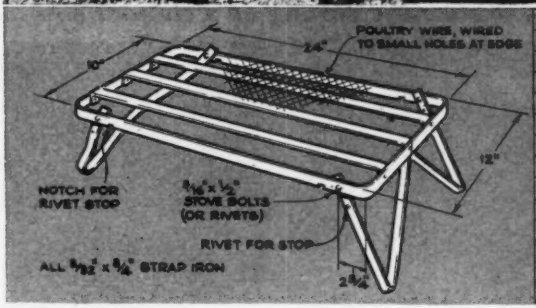
CUTTING LENGTHWISE is tricky; work tends to climb the wheel. Nor can the fork support be used; instead, a piece of strap iron bolted to the deflector rests on the saw fence (arrow). Work is held down and the user protected by a wooden bar clamped on table with a shim beneath.

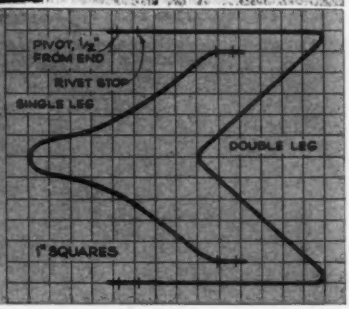
CONCAVE DISKS at right below, sold as saw stabilizers, grip a cutoff wheel better than undersized saw flanges. If blotters are too small, paste on new ones. Sight between wheel and stabilizers to make sure that they clamp on the blotters only, not on protruding edge of wheel bushings.

Tripod Grill Folds for Storage in Home or Car





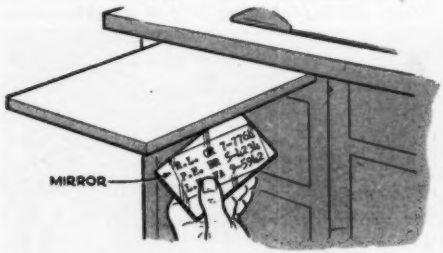




THREE legs support this folding grill on rough ground where one with four legs might not level. It's made of $\frac{3}{16}$"-by-½" stove bolts (or rivets), chicken wire and $\frac{3}{32}$"-by-¾" strap iron formed with a vise and hammer.

You need a strip of iron 5' 10" long for the upper frame. Before bending the frame to shape, drill holes for the leg pivots, the three frame longitudinals and for fastening the chicken wire. Lap the meeting ends of the frame and secure with a bolt, or tie them together with a short piece of strap iron, bolted or riveted. Saw the longitudinals 25½" long to allow for a ¾" bend at each end.

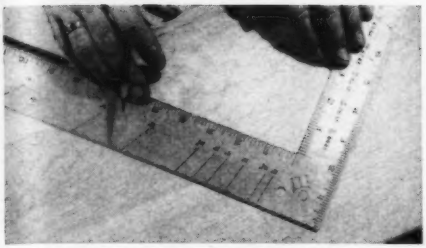
After drilling pivot holes in the legs, make a temporary assembly and set up the grill to see where the rivet stops should go. This will vary according to how you shape the legs. On final assembly, place washers between the legs and frame so that the legs swing smoothly.—*J. G. Wing, Santa Fe, N. M.*



Secret Information Concealed

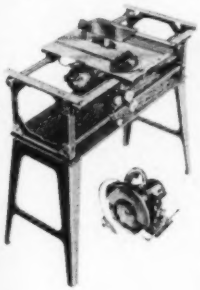
CONFIDENTIAL phone numbers and addresses can be kept secret by typing them in reverse and taping the paper to the bottom of a desk pull-out. To type in reverse, you set the typewriter for stencil and use the carbon paper backwards against the paper. To read the writing, hold a mirror under it.

New Tools



1. New Angle to Carpenter's Square. This aluminum square has all the calibrations that you usually find on a square, plus a "quick angle" scale. Line up one of the 10 pitch marks, ranging from 80° to 30°, and you've got the angle.

2. Table Saw Goes Portable. Pull this ¾-hp. circular saw out of its table mounting and you have an 8″ portable saw. A special shoe and guard enclose the blade for protection when it's hand-held.



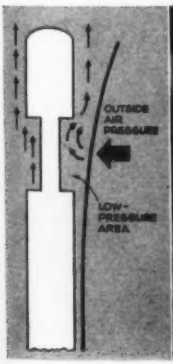
Shaper and jointer attachments come as standard table-saw accessories. Other attachments make the tool a lathe, drill press, sander, mortiser or router.

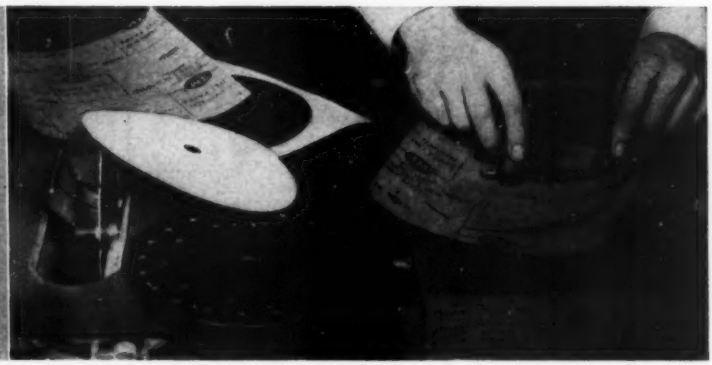
3. Magnetic Hand Positions Welding Work. Here is a magnetic third hand, with a 45-lb. pull, that holds material while it is being welded. Each magnet adjusts through a full circle, by a dial marked off in 5°, to grasp your work. A third magnet can be attached to top.

Further information on the products shown on this page can be obtained from: 1. Fairgate Rule Co., Cold Spring, N. Y.; 2. Reamstown Products Co., Reamstown, Pa.; 3. Standard Portable Cord Co., Mayville, N. Y.; 4. The Speed Corp., 4734 N. Albina, Portland, Ore.

4. Suction Holds Sandpaper to Disk. Blind holes in the rubber face of this 8″ aluminum disk hold paper against it as long as the disk turns. Skin friction and centrifugal force create a partial vacuum in the holes, as sketch shows. The greater outside pressure forces the paper to disk.

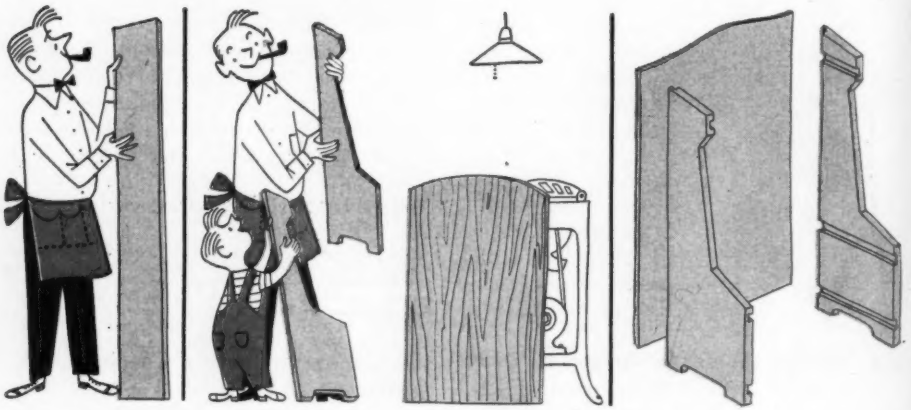
Attached to the shaft of a table saw, the disk can carry sandpaper on both sides. With the disk comes a tool that cuts circular sandpaper facings from standard sheets and punches a center hole.

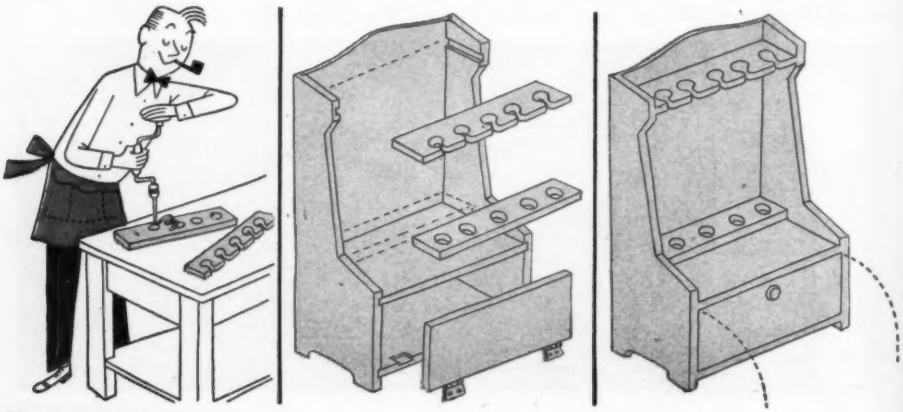


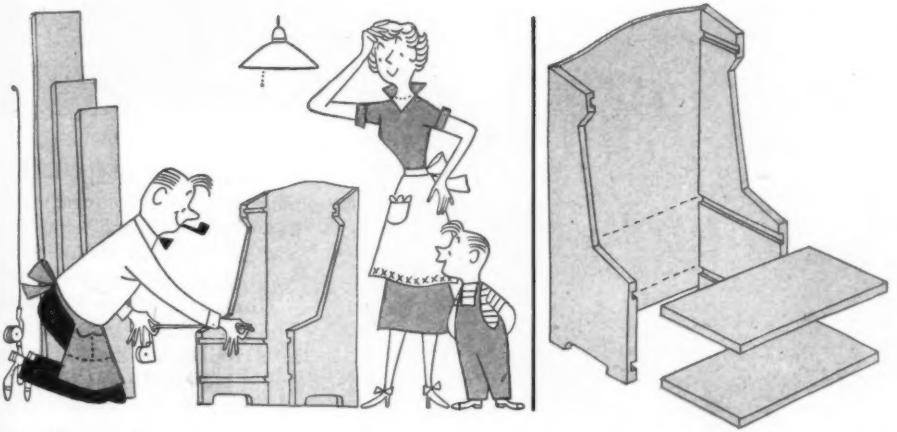


By Roy Doty and Ralph S. Wilkes

Wordless Workshop







Next Month: A space-saving rack for storing bicycles in a garage

Could You Bore a Square Hole?

You can with this offbeat tool: a triangular bit that turns in an ordinary carpenter's brace.

By Walter E. Burton

NEXT time you want to stump a tool expert, ask him how to make a square hole with a brace. While he's chewing it over, you can go ahead and show him.

This stunt will raise numerous eyebrows, but it has a practical use, too. The homemade bit on these pages does a good job of making mortises for square tenons. Turned by hand, it works as cleanly as a power-driven mortising chisel. A smaller bit, shaped from a file as shown on page 216, will make holes to fit gear racks, key stock, square shafts and so forth in metal as well as in softer materials.

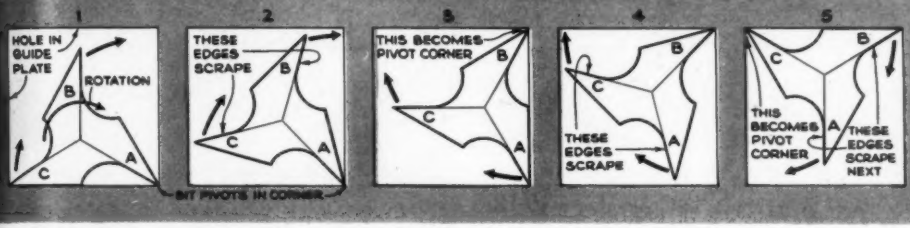
How it cuts corners. The three-sided bit works in a four-sided hole in a guide plate that you screw or clamp to the work. As the bit is turned clockwise, it "walks" counterclockwise from corner to corner of the guide hole, its outer edges serving as pivot points. Stock is removed by the scraping action of three edges on the end. Only two of these work at any one time, the third—acting as a pivot—going backward.

Shape it from round. Use a piece of round steel, faced square at the end (for a ¾" bit use a bar ⅞" in diameter). Prick-punch the center; then follow the drawing on the facing page, drilling the holes $\frac{5}{16}$" for a ¾" bit. Before filing the edges, drill a ¼" or ⅜" hole in the center of the other end for a shank.

In a piece of ⅛" steel drill a hole and

Here's how a three-cornered bit makes that square hole

KEY TO THE TRICK is the square hole in the metal guide plate clamped to the work as at right. If you start turning with the bit as at *1* below, it will pivot in a corner of the guide hole on point *A*. Points *B* and *C*, with their cutting edges, will sweep to the right, removing stock as in 2. Edge *A*, moving backward, will not remove stock. Reaching position *3*, the bit will begin to pivot on point *B*, in the upper corner of the guide hole. Points *A* and *C* will sweep to the left, their edges removing stock as in *4*. When point *C* reaches the next corner as in *5*, it becomes the pivot point, while *B* and *A* will next sweep downward, cutting as they go.



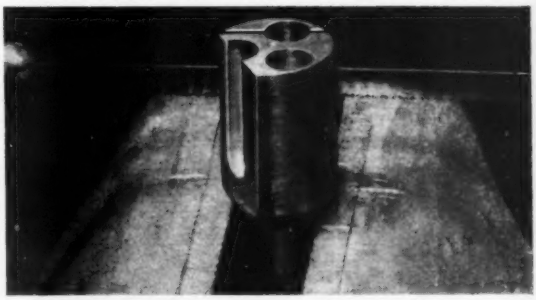
file it square. Use the bit as a gauge when filing to final size, making each side as long as one side of the bit. Drill two holes by which to screw the plate on the work in case clamping it on is not feasible.

For limited use in wood, the tool can be used as it is, but it will give longer service if heat-treated. If made of tool steel, the bit and plate can be hardened by heating red hot and quenching in water or oil. Low-carbon steel must be casehardened. After hardening, polish a portion so that the tempering colors can be easily seen. Then draw the pieces to a light yellow.

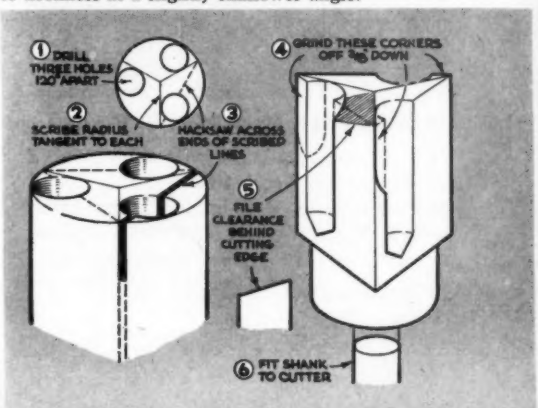
File one from a file. For a smaller bit, anneal an old triangular file by heating it red hot and letting it cool slowly. Grind or file the end square. Then shape it as shown on the next page and reharden it. Make a guide plate as described for the larger bit.

Using the bits. Because of their off-center action, it is best to turn the bits by hand. If you use them in a drill press, run it at the lowest speed, and remember that the work must be left free to wobble. Clamp a wooden fence to the table,

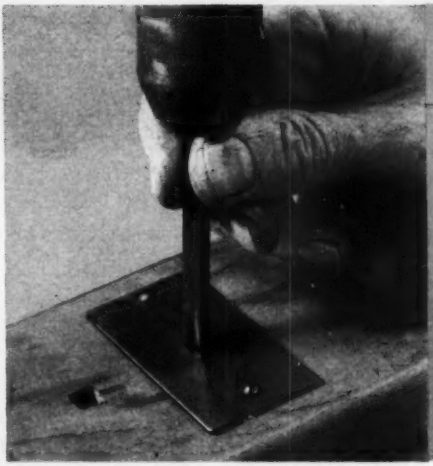
Bit is sawed and filed to shape



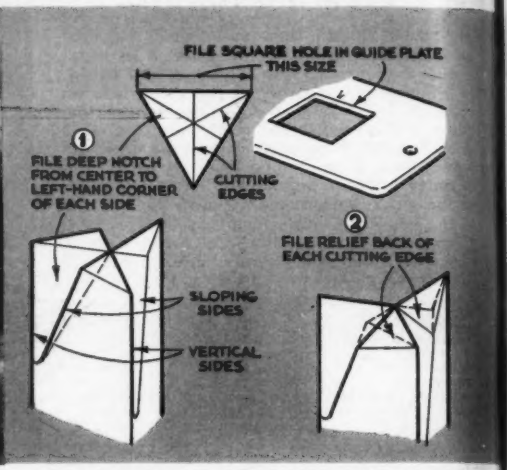
DRILL THREE HOLES from the end of the blank to help bring the bit to shape. Then hacksaw through these the long way as above, removing excess metal on three sides. File the cutting edges as shown in the diagram below. In filing the clearance back of each, stop 1/64" short of the very edge. Then oilstone this narrow line to keenness at a slightly shallower angle.


1 DRILL THREE HOLES 120° APART
2 SCRIBE RADIUS TANGENT TO EACH
3 HACKSAW ACROSS ENDS OF SCRIBED LINES
4 GRIND THESE CORNERS OFF AND DOWN
5 FILE CLEARANCE BEHIND CUTTING EDGE
6 FIT SHANK TO CUTTER

This smaller square-hole bit is made from a triangular file



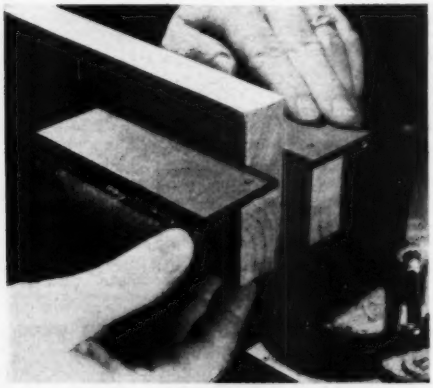
SCREW OR CLAMP the guide plate in position. Triangular bit will work even if not precisely centered in the chuck, but it should run straight to keep all three bottom edges in contact.


FILE SQUARE HOLE IN GUIDE PLATE THIS SIZE
1
FILE DEEP NOTCH FROM CENTER TO LEFT-HAND CORNER OF EACH SIDE
CUTTING EDGES
2
FILE RELIEF BACK OF EACH CUTTING EDGE
SLOPING SIDES
VERTICAL SIDES

ANNEAL THE FILE so that the end can be shaped by filing as shown above. Rehardening is easy: heat it red hot and quench. Temper by reheating until a polished part turns yellow.

close enough to keep the work from turning but leaving it free to oscillate. Turn the chuck by hand to check this before starting the motor.

Want to make hex holes? A five-sided bit turning inside a hexagonal guide hole will produce six-sided holes. The bit should be made of round stock of a diameter equal to the distance across the flats of the desired hexagon. This will make the sides of the bit the same length as those of the guide hole. END



"L" Blocks Pad Metal Vise

A MACHINIST'S vise will double as a woodworking vise if two L-shaped wood pads are used in it. Hardboard lips nailed to bits of scrap wood hold them in place on the vise while you adjust the work.

Oil Can Releases Single Drops

THE opening of an oil-can spout can be reduced to release one drop of oil at a time. Insert a small nail or brad; then pinch the spout around it with pliers or a clamp and remove the nail.

SECRET OF GOOD SPRAYING is moving the gun parallel to the work for even distribution, instead of swinging it like a brush. Stroke back and forth, aiming each new stroke at the bottom of the preceding one to make sure that you get double coverage with no missed spots.

How to Use a Spray Gun

By David X. Manners

NO DOUBT about it, spray painting is usually faster and better. But what do you actually do when you have a gun in your hand? It's loaded, turned on, you're ready to press the trigger—now what?

The main thing to remember is that a gun is not a brush—and you'll probably have to squelch the urge to swing it like one. This moves the gun in an arc, spraying on too much paint in the middle and too little on the ends.

Point the gun squarely at the work and move it steadily sideways as nearly parallel to the surface as you can. When you complete one stroke, go on to the next, never go back over the same area. In spraying, you build up the paint by putting on several successive coats, not by putting on a lot of paint in one coat.

You can pick up the basic technique of handling a gun in 15 minutes. After a few practice jobs, you'll enamel a chair in minutes instead of an hour, lacquer a car in one hour instead of four. What's more, you will produce a slick, glass-smooth finish that no master of the brush could ever get.

If you've ever had the experience of turning out a fine piece of woodworking and then ruining it with a second-rate finish, you'll agree that no shop should be without a sprayer.

Can I get by cheap? Inexpensive sprayers (some for under $10) are available that you just plug into an electric outlet or into one of your car's cylinders. You can also get an attachment that fits your vacuum cleaner. These are fine for small painting jobs. For heavier duty,

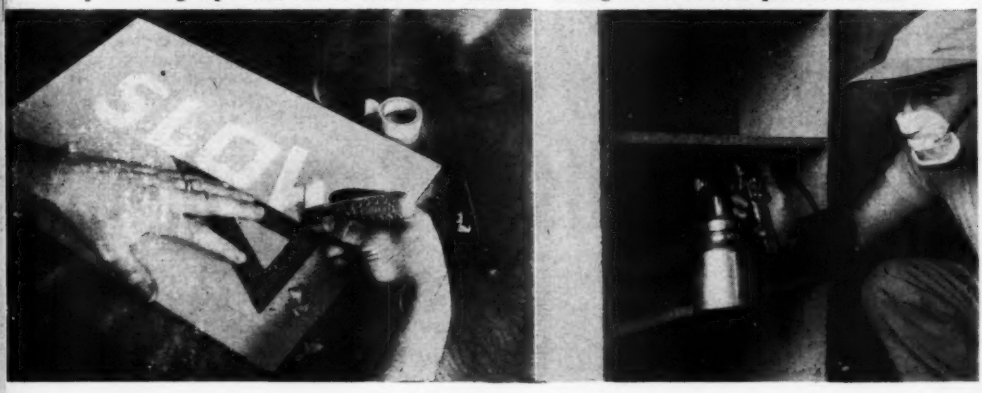
You can do jobs like these quickly with a sprayer

PICKET FENCE is a backache with a brush but a breeze with a gun. Spray up and down, holding gun at an angle to hit face and one edge. Repeat to catch backside and opposite edge.

SOAKED NEWSPAPERS make it easy to mask around window frames and trim in outdoor or semi-open areas. Papers stick on by themselves, peel off when dry. Don't spray in closed areas.

NEAT-LOOKING SIGNS can be made by pasting letters formed with masking tape over a background color. Spraying on second color and removing tape then leaves outlines of letters.

BOOKSHELVES and other hard-to-reach areas are quickly sprayed where a brush might miss. Always wear a mask when you are painting for a long time or at close quarters like this.



compressor-type sprayers, driven by an electric motor, are available for about $75 complete.

If you already have a ¼-hp. or ⅓-hp. motor, you can buy just the gun and compressor at a considerable saving. If you don't want to buy a gun, you can often rent one from a hardware or paint-supply store for a few dollars a day.

Don't get "trigger happy." The secret of smooth spraying is an even, continuous stroke. Don't pump the trigger on and off or slow down during a stroke —the paint will pile on unevenly.

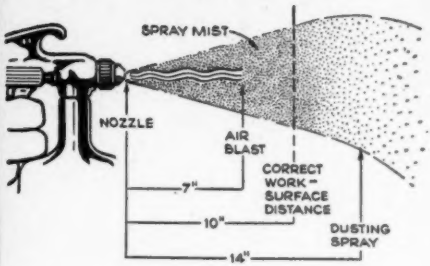
A screw at the back of the gun controls the flow of paint. For practice, it's best to turn this down until you get a pattern only an inch or so wide, then open it up to 6″ to 8″ as you acquire full control.

Keep the length of your strokes within a comfortable reaching range—about three feet. Begin a couple of inches to one side of the work and follow through the same distance beyond the opposite side.

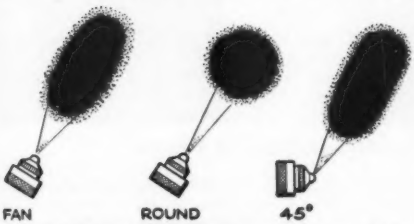
Move the gun at a uniform speed, about as fast as you would a brush. Aim each new stroke at the bottom edge of the preceding stroke to insure an overlap of at least half the depth of the stroke. As you become experienced, use less lap.

A HAND'S SPREAD AWAY, about 8", is a quick check against spraying too close. Correct distance is about 10", but may vary some depending on type of paint used. If the paint "globs" on, causing runs, you're too near; if it just "dusts" on, then you are too far away.

Spray at the right distance

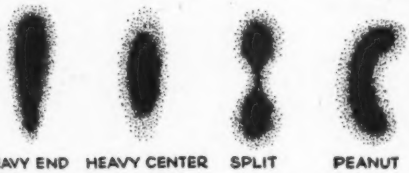


Adjusting the nozzle lets you fit the spray to the work

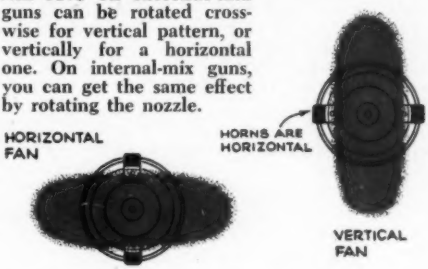


INTERCHANGEABLE NOZZLES produce an oblong pattern for long, slender work, a round one for large areas, or an angled spray for reaching high or low spots without tilting the gun.

AIR JETS on external-mix guns can be rotated crosswise for vertical pattern, or vertically for a horizontal one. On internal-mix guns, you can get the same effect by rotating the nozzle.



AN ODD-SHAPED PATTERN indicates a dirty or partially clogged nozzle. If center is heavy, reduce fluid flow with screw adjustment. If pattern splits, air volume may be too high.



Sags, runs, orange peel? Paint for spraying should be 10 to 20 percent thinner than for brushing. But if it runs or sags, it may be too thin.

If it seems to pile on too quickly, hold the gun farther from the work or move it a little faster. Remove runs with a brush or a swipe of the hand—a cloth may leave lint.

Paint that's too thick may produce a pebbled surface that looks like an orange peel. Try thinning it, but first make sure that there are no air leaks to cause loss of pressure. The compressor's safety should also be kept tightly closed to maintain pressure, except at the start when it should be opened to permit warm-up without load.

Be sure to ventilate. It's never wise to spray indoors—and in some communities it is illegal. But you can still make use of your compressor by hooking it to a pressure-type paint roller.

Even in semi-open areas such as a

Be sure to do your painting in a well-ventilated place

WORK IN AN OPEN GARAGE or outdoors, never in a fully enclosed area, so that you do not breathe concentrated paint fumes. Place the work at arm level, either on sawhorses or by suspending it on wires, so that you don't have to tilt the spray gun too far up or down.

Prepare the paint carefully

TO PREVENT CLOGGING, thin regular paint 10 to 20 percent and filter it through an old nylon stocking. Thin clear lacquers 25 percent, pigmented lacquers about 100 percent. In humid weather, add 10 percent retarder to keep lacquer from "blushing"—turning a milkish white.

garage or porch, open all doors and windows to get as much ventilation as possible. Masks that filter out the paint fumes cost about $4 and should be worn. Never paint near a furnace, running car engine or open flame.

What kind of sprayer? You'll find that there are two types of guns—pressure-feed and suction feed. Pressure-feed guns use air directly to *push* the paint out of the nozzle. These are particularly good for heavy house paints, floor enamels and other thick mixes.

Suction-feed guns use a siphon action to draw the paint out. Their "plumbing" is a little simpler and thus easier to clean—an advantage if you are making a lot of color changes. They are especially fine for lacquers and other thin materials.

Types of nozzles. Your gun will mix the paint either inside or outside of the nozzle. Internal mixing provides finer atomization of heavy paints. External mixing is better for quick-drying paints that might clog an internal-mix nozzle.

Choose a gun with a nozzle that best suits the type of painting that you do most often.

Watch out, too, for two types of air-control systems—"bleeder" and "non-bleeder." Non-bleeder guns require an air-storage tank and are usually found on heavy-duty professional rigs. Bleeder guns that pass air continuously are much cheaper. You just "bleed off" air as you need it by pressing the trigger.

Preparing the surface. Because of the thinness of the spray coats, it is important to start with a smooth, clean surface, particularly on metal. Sand all spots where old paint has chipped or broken away, feathering the edges smoothly.

If you get down to bare metal, use a primer on it first. Remove grease and dirt with a solvent. If you are painting near an edge or corner where the over-spray may fall on something behind it, tape on pieces of cardboard to catch the paint.

Always apply fast-drying materials so that the over-spray falls on unfinished work. In spraying a door or table, start at the near edge and work away from you. Spray falling on finished areas produces a sandy texture.

For best results, be prepared to spray on as many as three to five or more coats. Even at this, you'll find that spray painting is still four to six times faster—and a sparkling world of beauty better. END

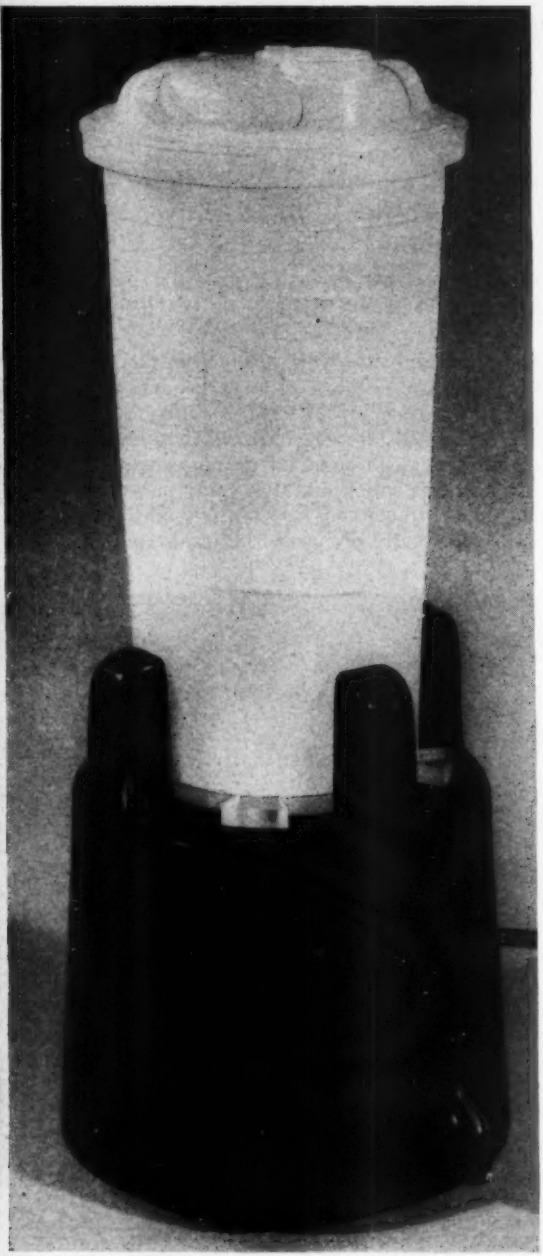
Clean the gun right after use

SCRUB PARTS with solvent and an old toothbrush, then spray solvent until it comes out clear. Clean air jets with a broomstraw or toothpick, nothing hard that might distort them.

Your spray gun will do many other jobs like these

AIR-GUN ATTACHMENT blows chips from saw cuts and quickly dusts out motors, typewriters and other inaccessible spots. Regular gun will spray insecticides on plants (above right) and put a protective oil mist on power mowers and other tools. You can also use the compressor alone to inflate tires and water toys, operate a small forge, even do sandblasting.

I Built Our Kitchen Blender



By Herbert R. Pfister

THE blender that I built cost only a fraction as much as a factory-made job, but it performs as well as the best of them. Pour in a glass of milk, add some sliced banana and the banana will disappear in seconds to make a creamy, healthful milk drink. Mixed party drinks take on new flavor when blended violently with cracked ice.

A husky sewing-machine motor housed in a wood base powers the blender. The mixing jar is a separate plastic container with a stainless-steel blending knife mounted on a shaft in its bottom. The shaft turns on a bronze bearing and a ball bearing, both set in clear plastic where they can't come in contact with the food. A rheostat gives a whole range of blending speeds.

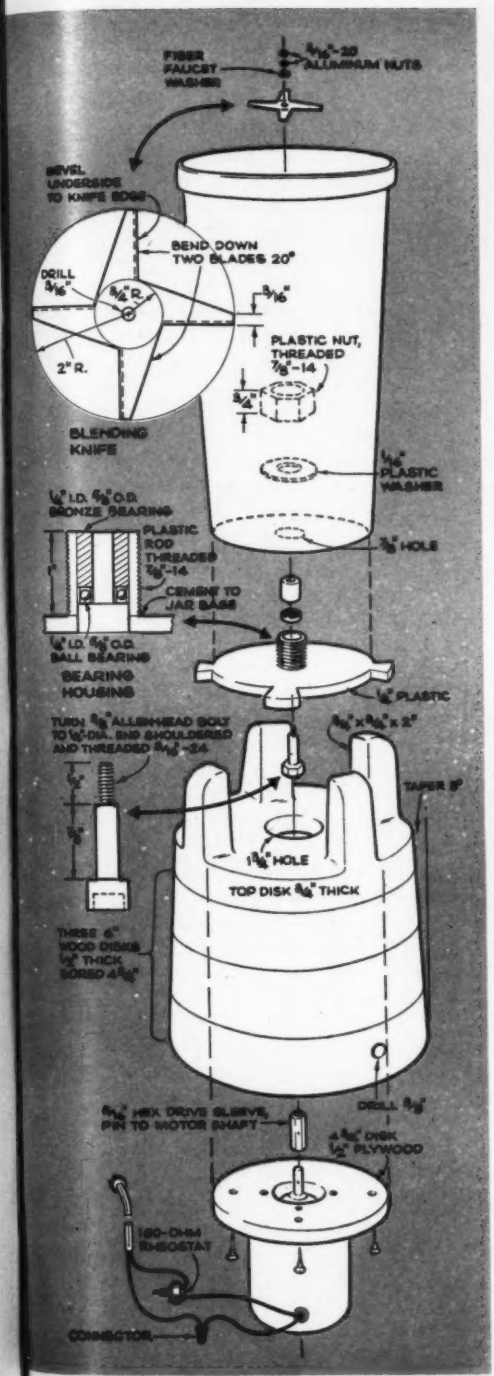
The base. A hollow housing for the motor was built up by gluing three wooden rings on top of each other. These are 6″ in diameter and 1½″ thick. The centers were cut out with a circle cutter set to 2⅜″ radius. A disk of ¾″ pine with a 1¾″ hole in its center was glued on top of the rings.

Tilting the table of a disk sander 3° tapered the base as it was sanded round. Four jar supports glued to the top of the base were then sanded to match the tapered sides. The rheostat is mounted in a recess chiseled on the inside near the bottom.

After the wood had been sealed with several coats of shellac, the base was enameled to match the kitchen finish.

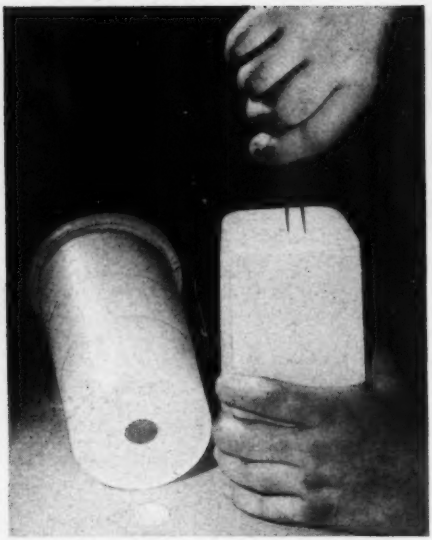
Motor and drive shaft. The motor is bolted to a 4¾″ disk of ½″ plywood held by screws inside the base.

Motor torque is transmitted by a short piece of $\frac{5}{16}$″ hexagon rod drilled to fit over the ¼″ motor shaft and pinned to it with a brass escutcheon pin. The top edges of the hex were rounded to slip easily into the socket of an Allen-head

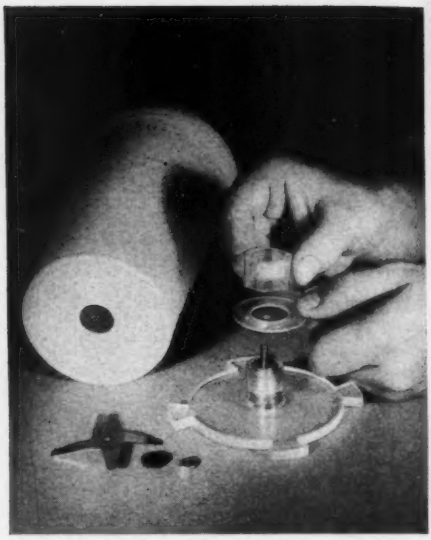


SMALL RUBBER DISKS punched from a tube patch were cemented to the top of the wood base to cushion the blending jar. Note the hex drive shaft protruding from the center hole.

RHEOSTAT IS HOOKED UP with a piece of #18 rubber-covered cord, one leg running through the rheostat, the other direct to the motor. The base rests on three rubber-headed tacks.



SHARP DIVIDERS set to a 7/16" radius easily cut the desired hole in bottom of blending jar. The dividers can also be used as above to cut a washer from a spare juice container.



LARGE PLASTIC NUT turns down on threaded bearing housing after the latter has been thrust up through hole in bottom of jar. Aluminum nuts and a fiber washer hold the knife.

screw that serves as the blending-knife shaft.

Blending jar. This is a quart-size plastic juice container with a lock-on top. A ⅞" hole was cut in its bottom. A base for the container, cut from ¼" clear plastic, was shaped so that ears would protrude between the four wood posts of the motor housing.

After a ⅜"-14 thread had been cut in a 1" piece of ⅞" clear plastic rod, the rod was cemented to the center of the container base. Letting the cement dry, I then chucked the assembly in a lathe and made a tight ⅜" hole for a bronze bearing and ball bearing. Plastic solvent softened the bore so that the two bearings could be pressed in place. The seal nut was made from a chunk of ¾" plastic, a large steel nut serving as a template for cutting the hexagon sides. The seal nut was then threaded to fit the bearing housing.

Blending knife and shaft. The knife was hacksawed from a 2½" square of $\frac{1}{16}$" stainless steel. The leading edge of each blade was filed to a sharp bevel. Two blades were bent downward about 10° to agitate food at the bottom of the container.

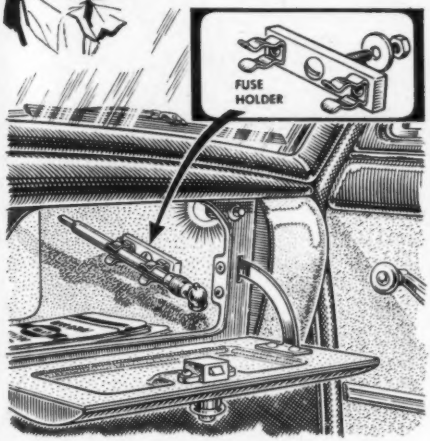
It was necessary to check several ⅜" Allen-head bolts to find one with the hex socket well centered in the head. The threaded part was turned down to .250" diameter, the end shouldered and threaded $\frac{3}{16}$"-24. A fiber faucet washer and two $\frac{3}{16}$"-24 nuts hold the knife on the shaft.

Operation. Before using the blender, I packed the ball bearing with petroleum jelly. Each time it is used, we put one or two drops of light oil beside the shaft head and stand the container upside down so the oil penetrates the shaft.

When we mix cold drinks, the use of shaved ice or broken-up ice cubes avoids bending the knife blades. It helps to cut foods into pieces the size of lump sugar and run the blender at medium speed for a minute, then turn it up to high speed and keep it churning until all lumps disappear.

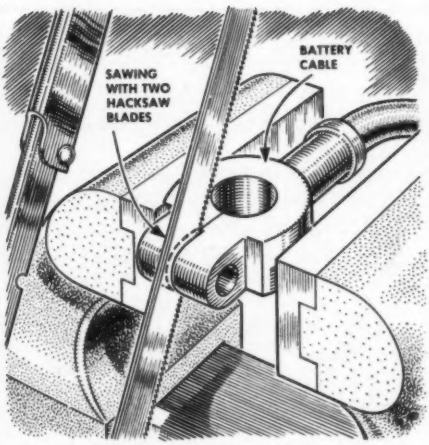
To wash the blender, we half-fill the container with warm water, add a small amount of detergent and run it at high speed for a few seconds. END

Hints from the Model Garage

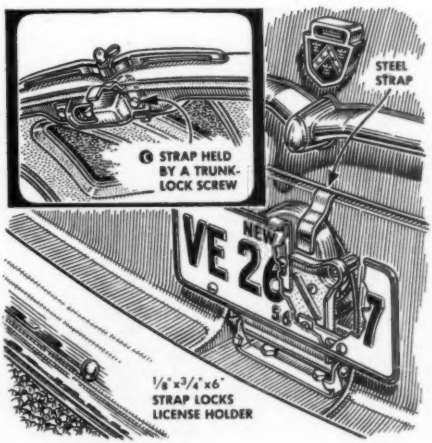


Want to store a tire gauge in a safe and convenient spot? Mount a suitable fuse holder inside the glove compartment and you've got it. The holder can usually be bolted to the side of the compartment.

Removing a window channel to replace the glass is often a tough job, especially if rust has formed on the metal. To save time and temper, apply heat to the bottom side of the channel with a torch.



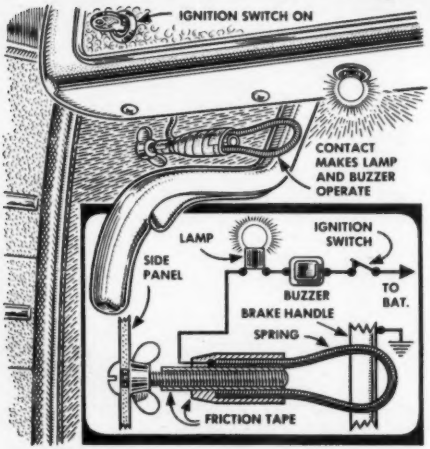
If the hole of a battery clamp is too big to fit snugly on the post, remove the cable from the car, clamp the terminal in a vise, and hacksaw along the lips with two blades. This removes enough metal to fit the clamp to the post.



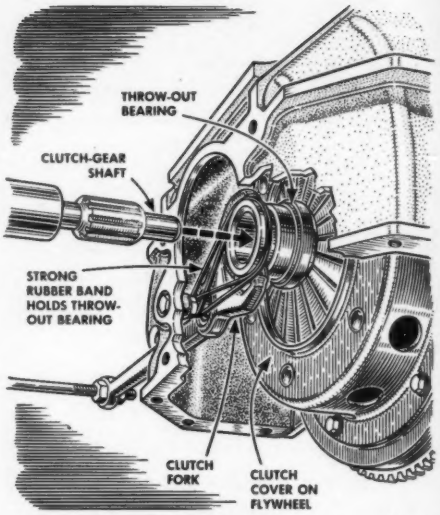
A rear trunk key also serves as a gas-cap key in this setup for a car that has the filler pipe hidden behind a tilt-down license plate. A steel strap projecting from the deck lid prevents access to the gas cap until the lid is lifted.

Please turn the page for more auto hints

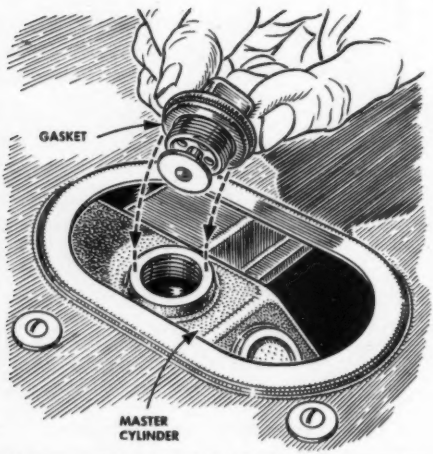
More Hints from the Model Garage



A parking-brake signal will cure the absent-minded who tend to start off with the brake set. A buzzer buzzes and a light stays on until you push the brake handle away from the coil spring, breaking the circuit that is set up when the ignition switch is turned on. Tape insulates the spring from its mounting bolt.



In reassembling a clutch, one mechanic uses a rubber band to keep the throw-out bearing in its yoke while he pushes the transmission clutch-gear shaft through it. Left in place, the band soon breaks and falls out of the way. The idea is especially good for Chevvy clutches but can also be used on some others.

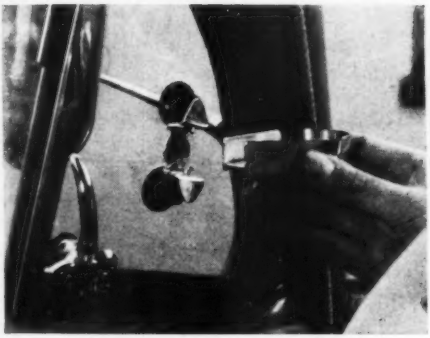


When adding brake fluid to the master cylinder, be sure that there's a gasket under the cap—or it may stick the next time you try to remove it. And don't tighten too hard. Caps sometimes break.

Exhaust gases tend to swirl forward into a station wagon when it is driven with the tailgate down. If you must keep it open, remember to open all the windows and ventilators while you drive.

New for Your Car

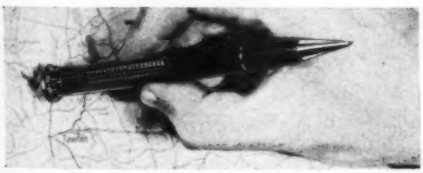
1. Store-Away Snack Bar. This metal tray hooks into the car-window channels and serves as a food counter for either the front or rear seat. You can telescope it for storage, expand it to 70″, adjust its height 5″ and level it with the turn of a knob.

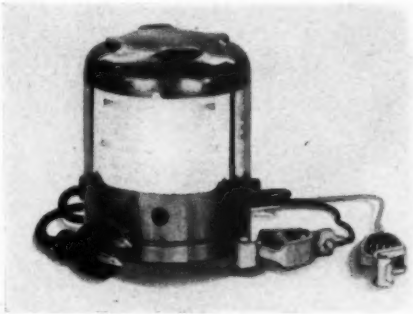


2. Ash Tray Sticks to Vent Window. A driver can flick cigarette ashes into this ash tray without taking his eyes off the road. Suction cups hold it to the vent window. The tray slides in and out.

3. Socket Removes Spark Plugs. A new socket with a special rubber insert unscrews hard-to-reach spark plugs. It comes in sizes to fit ⅜″- and ½″-drive socket wrenches with $\frac{13}{16}$″ hex holes.

4. Pencil Measures Distance. Roll the revolving head over a route map, and a mechanism in the pencil below registers inches on the side scale. Take this and the fraction shown on the head, and convert it to miles from the map scale.





5. Low-Cost Battery Charger. This unit uses house current to bring a weak 6- or 12-volt battery up to starting strength within a few hours. The juice cuts off when the battery is charged.

Further information on these new car products can be obtained from: 1. Cartra Mfg. Co., 1924 Edgewater Terrace, Topeka, Kan.; 2. Petoskey Mfg. Co., 505 Liberty St., Petoskey, Mich.; 3. P & C Tool Co., Box 5926, Portland 22, Ore.; 4. Gift Horizons, 475 Fifth Ave., New York City 17; 5. Buckeye Stamping Co., 555 Marion Road, Columbus 7, Ohio.

Overhauling

By J. W. Rocke Jr.

ROLLING out my power mower that Saturday morning, I spotted Cam Evans hauling his own out of the storage shed and waved to him.

Cam waved back and, pointing to his mower, did a quick pantomime of a fellow rolling up his sleeves to go to work. Having just overhauled mine, I nonchalantly wound up the starting cord and gave it a yank. I had just test-run the engine, so it caught immediately.

"JUST PUT IN NEW RINGS," I yelled. "DID THE JOB IN THREE HOURS ON A BET . . ."

Right there my engine quit with a couple of sharp knocks. Shaking his head in mock sympathy, Cam lowered his machine into his basement. I yanked the starting cord. And yanked. And yanked . . .

A ring job backfires. "So I bought this wrench set," I explained to Cam 10 minutes later, "and Madge kidded me about them. I said they'd save us money—bet her the price of a new hat that I'd have the mower engine overhauled before she got back from a matinee."

Cam was brushing off his mower. "You've won, haven't you?"

"Yeah. Only it won't start, and she'll never admit I won if it isn't running."

"Want me to come look at it?"

"Sure do. The trouble is," I said as we went up, "there's no compression. Maybe the new rings aren't seated yet."

"It may help to squirt some oil through the spark-plug hole," offered Cam. "That may give enough compression for starting. You have an oil can with you. Might as well try it."

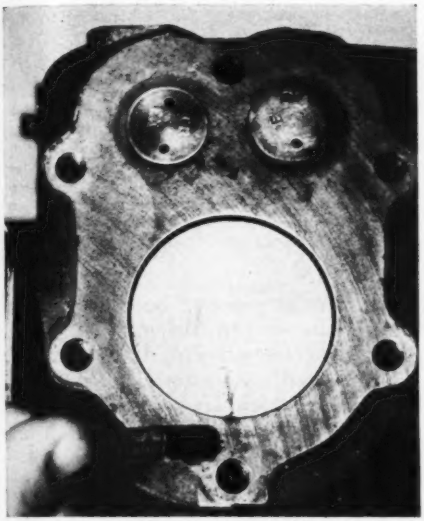
"Good idea." I unscrewed the plug and, squirting oil in, turned the starting pulley while watching the top of the piston through the hole.

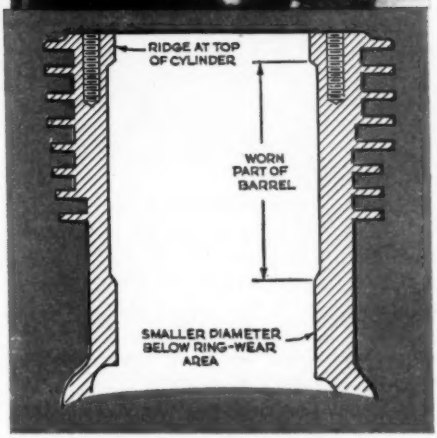
It didn't budge.

"Hey, the piston just stays up!"

Cam peered over my shoulder. "Afraid

Your Lawn-Mower Engine





A CRAYON MARK on the piston and block (above) helps orient the piston the same way on reassembly. Thickness gauge (above right) indicates bore wear. Caution: if fitting a new piston, push gauge and piston down to bottom of stroke, where it is tightest. Drawing shows characteristic pattern of cylinder wear.

you're right. Better take the head off."

We wrestled the mower into Cam's shop. After taking the head off, I turned the shaft over. The piston stayed almost flush with the top of the block.

Shoving it down with a hammer handle, I gave the pulley another twist. With a sharp click the piston head popped up —and fell out on the bench.

Cam picked it up and turned it over. You could see that the head had broken off in the top ring groove.

"How much ring gap did you leave?" Cam asked. "A thousandth or two?"

I shook my head. "I got oversize rings. The salesman said they'd be best for a worn engine. They were so tight I could hardly get them in. So I'm sure there was no gap."

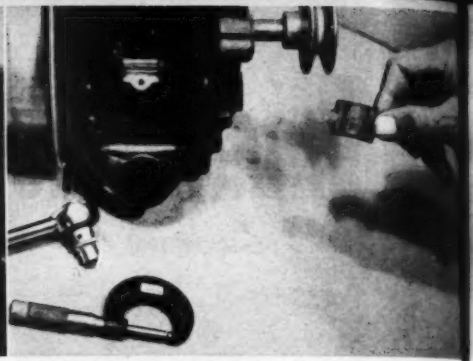
"But there should have been," said Cam. "You better rush downtown for a new piston. I'll explain later."

Why the piston broke. In 30 minutes I was back with an oversize piston that the clerk said would fit.

"He's probably right. But why not check and make sure?" asked Cam, handing me a thickness gauge.

With the new piston down to its lowest

IN GRINDING VALVES, put a light spring temporarily under valve. Twist the valve back and forth but don't make complete turns. Let spring lift valve frequently to allow fresh compound to flow in. To check job, make soft-pencil lines across seat. Drop valve in place and twist one-eighth of a turn. Marks should be wiped away evenly all around on seating area.



BIG-END CAP may already be marked for reassembly; if not, put punch marks on it and the rod. Bearing clearance can be checked by putting a shot-sized bit of rosin-core solder under the cap and tightening it. Remove and measure flattened solder with a micrometer. If clearance is excessive, dress off flat surfaces of the cap and, in extreme cases, of the rod big end also.

position, I could just get the gauge in alongside it.

"That's okay," Cam pronounced.

"Now to snap on the new rings before Madge gets back," I said.

Cam said nothing until I was flexing my thumbs for the job of wangling them on. Then he came over.

"Want to check ring gaps first?"

"Guess this is where I went wrong before," I admitted. "What is ring gap?"

"Well, a ring is a rolled-up length of metal. When hot, it expands. There has to be a small gap between the ends to let it stretch. Otherwise, it will jam in the cylinder."

"Uh-huh. So that's what happened."

"That's right. To check the gap, push the top ring into the cylinder."

Wear leaves ridges. The ring was a tight squeeze in the top of the bore.

"Shove it down," said Cam. "The cylinder isn't worn up there because ring travel never goes that high."

Because the ring was cocked in the cylinder, I pushed it down with the piston to straighten it.

"Good dodge," Cam nodded. "Now try the thickness gauge in the gap."

"Three thousandths," I reported.

"Not enough for the top ring. You want at least seven thousandths. File it with this." Cam gave me an ignition-point file.

While he returned to his own job, I fitted all three rings. Then I noticed he was using a tool that I had never seen.

"It's a ridge reamer," he explained on noticing my interest. "I borrowed it, and it's a good thing I did. Look at this."

He pointed to the top of the cylinder bore, from which he had removed the piston.

"Mine's an older engine, so the cylinder is worn. See that ridge a little way down? That's where the upper ring stops at top dead center. Above, the cylinder is its original diameter. Below, it's so worn you can see the step."

"But if the top ring never goes past it, what does the ridge matter?"

"A new ring may hit it. Besides, the oversize rings I'll have to use are bigger than the original ones. They'd never go past this part. So I'll ream it out."

Cam turned the tool slowly. When he was done, there was no sign of a ridge.

"Nice work," I said. "Well, I'd better get my rings on before Madge shows up."

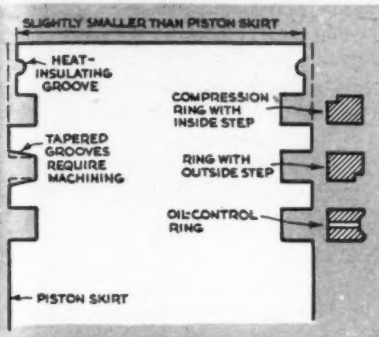
"It's easier to check side clearance," Cam said mildly, "before they're on."

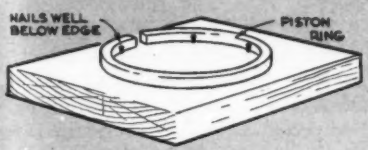
"Guess I was cutting corners again. What's side clearance?"

Cam laughed. "It's the elbow room each ring has in its groove. Too much causes early wear or breakage. Too little may make it seize in the groove so that it can't seal against the cylinder wall. Look, I'll fit one."

Smearing valve-grinding compound on a piece of plate glass, he laid the ring flat and rubbed it about with a circular motion. Then, he washed the ring in ker-

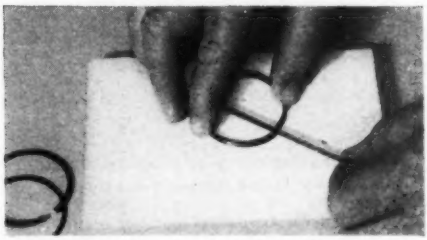
How to fit new piston rings





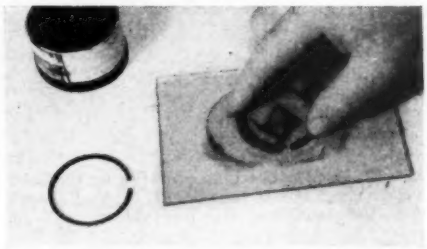
WORN PISTON GROOVES or excessive side clearance can lead to ring breakage. Too little clearance can make a ring seize in groove or cylinder. A holding board with the ring sprung over a circle of nails provides even lapping pressure.

PUSH RING DOWN with the piston to insure having it square to the cylinder axis. Then insert gauge leaf to check the end gap as shown above. The top ring requires the biggest gap.



TO ENLARGE END GAP, use an auto ignition-point file like this. Take care to keep the ring ends square and parallel. Recheck the gap frequently as shown in the top photograph.

MEASURE SIDE CLEARANCE with ring in groove as above, or held in the groove from outside. Even clearance too small to admit .0015" gauge is all right provided ring is free in its groove.



LAP PISTON RINGS, if they are a tight fit in their grooves. Use either valve-grinding compound on a piece of plate glass (above) or fine abrasive cloth tacked face up on a perfectly flat board.

osene and tried it in the piston groove.

"One-and-a-half thousandths is okay," he said. "Or even less if it's not tight."

My rings were tight. I lapped them until the thinnest gauge would just fit into the groove with them.

"Hope I don't break any getting them on," I said. "I busted one last time."

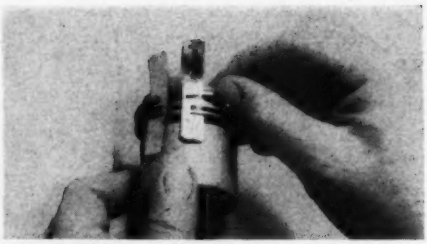
Cam nodded. "It's a touchy job." He gave me three strips of thin, stiff sheet metal. "Try pushing the rings down over these. Slide the strips out when each ring is over its groove."

It took care, but the job was easier than the first time. I had all three rings on when a heavy body seemed to fall down the cellar steps. It was Bud Nolan.

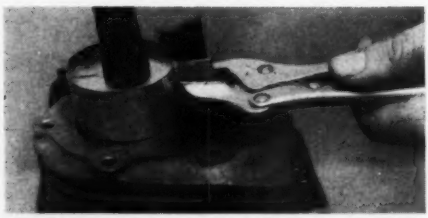
"Hi, Mr. Evans. Hi, Mr. Foster."

Cam looked at me. "Bud's record from the front door to where he stands is three seconds flat. What's up, Bud?"

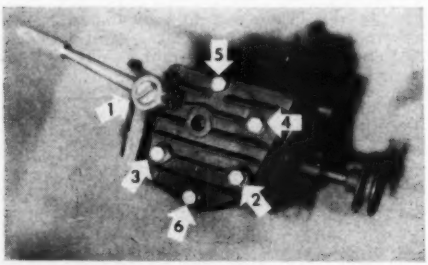
The teen-ager's brow wrinkled. "I'm



BEING BRITTLE, piston rings may break if you spring them too much on reassembly. Thin metal slides will help prevent this breakage.



A RING COMPRESSOR snipped from tin-can stock simplifies the task of sliding the piston in. Tap piston top with a wooden hammer handle.



TIGHTEN THE HEAD evenly, drawing up the bolts a little at a time. If your engine manual doesn't give the sequence, the one shown will do.

either in business, or in plenty trouble."

"Bud found a bargain in a power mower," Cam explained. "He's planning to buy it to earn money mowing lawns."

"I did buy it," said Bud. "But Mr. Bellefont wouldn't let me try it—I had to take it as is. And now it won't start."

Cam frowned. "Must be that two-cycle job he bought three years ago. He swore it was a lemon, and switched to a four-cycle machine."

"I got stung, huh?" quavered Bud.

"No, I think the trouble is Mr. Bellefont, not the engine. Let's see."

While they carried Bud's job into the cellar, I oiled the rings on mine, put the bearing cap back, and replaced the head. Then Cam helped me get the machine outside. I restarted it, and that staccato pop sounded like Beethoven's Fifth to me. I let it warm up, then shut it off and returned to Cam's workshop.

"Works fine," I reported.

Hunched over Bud's machine, Cam only nodded. "These two-cycles start fine," he said, "if you keep 'em clean. This one has reed valves in the intake. The air cleaner is all choked up and the chances are the valves are, too. Take them off, Bud, and rinse them in gas."

Back at his own engine, Cam laid a tiny bit of solder in the big-end cap, tightened it, and took it right off again. With a micrometer, he measured the flattened pellet. Then he stroked the bearing cap along a wide file.

"No wonder the bearing was a bit noisy," he said. "This will quiet it."

Off with its head. His engine reassembled, Bud was spinning it madly.

"Hold it," said Cam, and Bud paused, panting. "Did you try the spark?"

"Sure—look." Bud held a hammer head to the plug and twisted the engine. A spark snapped over. "But those valves had grass in them all right."

Cam nodded. "Is it getting gas?"

"Oh sure, the tank was half full."

"That gas-and-oil mixture causes clogging if it's left in all winter. Drain the tank, Bud. Blow out the gas line, and clean out the sediment bowl."

From outside I heard our car. "Madge is back," I said. "Thanks again, Cam."

Going upstairs, I spun the starting pulley over. There was only a sigh from the engine. As I spun it again, the engine wheezed over the compression stroke. I turned to see Cam watching.

"Sounds like a leaking head gasket."

"But I used a new one, and pulled the cap screws down hard, all alike."

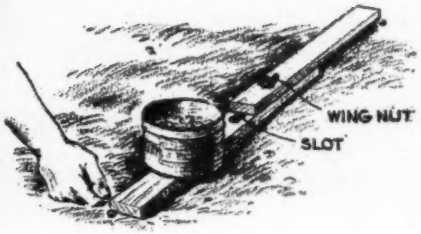
"Spin it," Cam said, and while I did so he squirted oil along the head joint. It bubbled madly. "Better yank the head again," said Cam.

With the ratchet wrench, I set a record

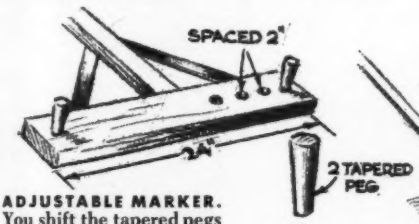
[Continued on page 268]

7 PROJECTS FOR THE Gardener

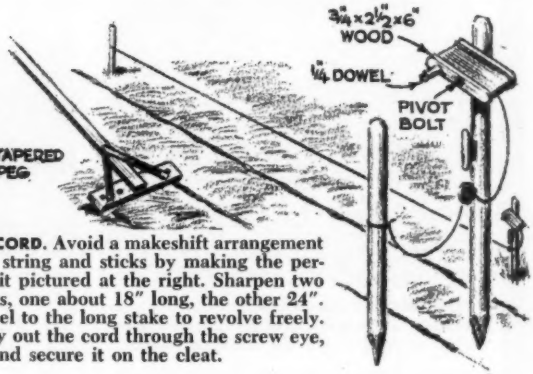
RUBBER-TIRED HOE. A garden cultivator becomes a lot easier to use if you replace the iron wheel with a bicycle wheel. Inflate the tire just enough to give it a slight springiness.



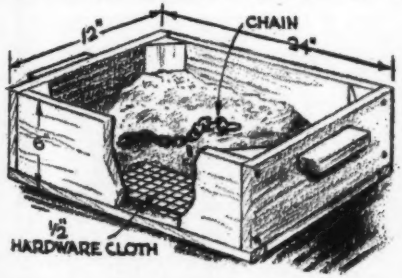
SEED SPACER. This adjustable spacer eliminates guesswork in spacing seeds in the row. Set it with a ruler to the spacing given on the seed packet. Carry your seed supply in the can.



ADJUSTABLE MARKER. You shift the tapered pegs in this rake-like marker to vary the distance between rows as specified to suit different vegetables or flowers. Make it of pieces of scrap wood. Use stakes and a cord to mark off the first row.

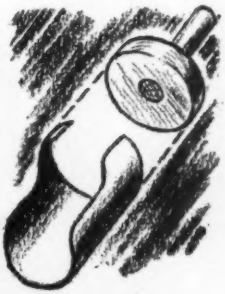


MARKING CORD. Avoid a makeshift arrangement of tangled string and sticks by making the permanent unit pictured at the right. Sharpen two broomsticks, one about 18" long, the other 24". Bolt the reel to the long stake to revolve freely. To use, pay out the cord through the screw eye, pull taut and secure it on the cleat.



COMPOST SIFTER. This box is handy for removing the larger chunks remaining in composted material. A piece of fairly heavy chain helps force the compost through the sieve as you shake the box. Wood strips hold the hardware cloth to the bottom of the box.

GRADUATED PAIL. Mixing liquid fertilizer will be easier if you paint on the markings. Use a quart measure and water to find the levels.



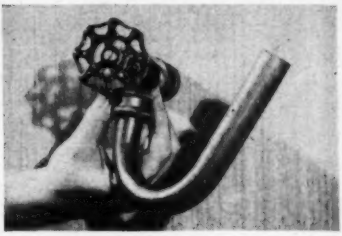
SCOOP. A wood disk, a broomstick and a tin can are what you need. Use it for fertilizer.

Blocks Hold Builder's Sand Pile

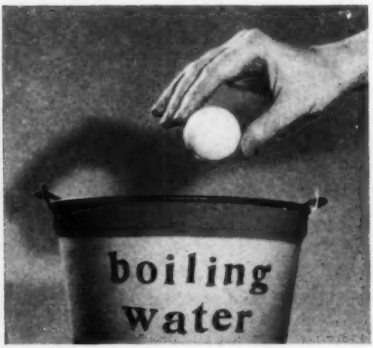
A CIRCLE of cinder blocks around a pile of sand and stone will keep your concrete aggregate from spreading and mixing with the surrounding dirt.

Hose Makes a Fountain

THE bent end of a washing-machine drain hose is a ready-made drinking fountain. Next time you put on a new hose, salvage the old tube and screw it onto an outside faucet; or you can find one at a service shop.



DO IT THE EASY WAY

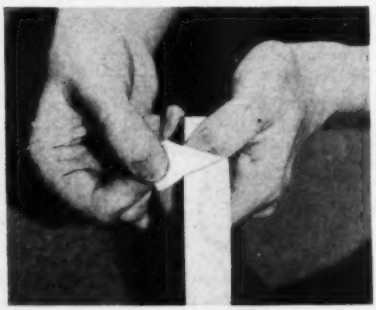


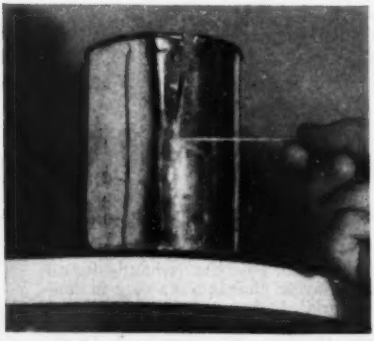
PING-PONG BALL DENTED? Hold it under boiling water with a stick. Expanding inside air will cause the dent to pop out.

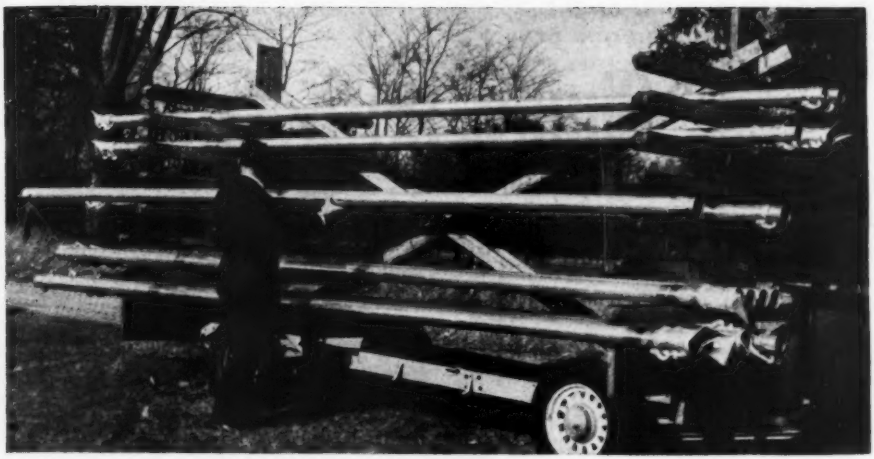
TO CLEAN THE LETTERS on a typewriter, press some adhesive tape on them. Lift the tape and the dirt will come with it.

CUT A NARROW V SLOT in one side of a can, screw the can to a shop shelf, and you have an easy-to-use string dispenser.

BEND THE TAPE END at a diagonal like this after cutting a piece from the roll. Next time you'll have no trouble starting it.

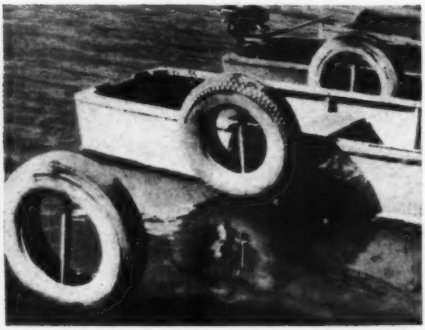






Mobile Rack Carries Sorted Irrigation Pipe to the Job

For transporting irrigation pipe on his farm near Sarasota, Fla., James Whitaker built this mobile rack. To an old car chassis, he bolted heavy lumber uprights and attached arms that hold the pipe according to size. He tows it to a work site at the back of a truck. The rack handles about 3,000′ of 20′ sections.

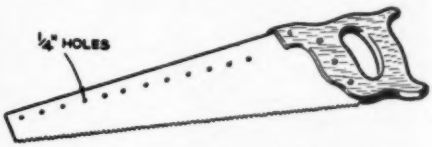


Tires Form a No-Chafe Boat Slip

A boat slip like this, made with discarded tire casings and some lengths of pipe, won't chafe the paint on your hull. Mount the casings by driving the pipe through a hole cut in the tire tread and space the casings a foot or two farther apart than the width of your boat.

Paintbrush Becomes a Scraper

Using a worn-out paintbrush and hardware cloth, you can make a wire brush for scraping off paint and varnish. Just replace the bristles with the screen, folded into layers in the ferrule.



Grease "Cups" Speed Sawing

Sawing wet logs is less of a chore if you drill several ¼" holes in the blade and pack them with heavy grease. As the saw heats up, the grease melts and lubricates the blade. One way to drill the holes is with a high-speed twist bit in a hand drill, using cutting oil generously, or you can punch them on a lead block.—*George H. Holden, Chesterfield, England.*

Every woodworker ought to know the technique of

Gluing Up a Table Top

By Warner G. Tilsher

PLYWOOD is wonderful stuff and none of us would want to be without it. But for real class in certain projects there's just nothing like solid wood. Jointing the edges and gluing up narrow boards gives you solid wood in any width.

Let's see how you should do the job, for instance, when you want a wide board for a table top or other cabinetmaking job where plywood would present an edging problem. Done right, jointing overcomes the warping that's sure to occur in a single piece of solid stock.

Saw off the stock an inch or two longer than you want the finished top. Rip the boards (if necessary) so they are at most 5″ or 6″ wide and add up to the total width that you want.

Look over the boards and decide which is the better side of each. Lay them side by side the way they match up best. Make every effort to assemble the pieces so that the growth rings on their ends change direction, one up, the next down and so on *(Fig. 1)*. In that way each piece helps counteract the strains imposed by its neighbor and the finished board will stay flatter.

SOLID WOOD AND WIDE AS YOU WANT. That's what you get by jointing and gluing together stock narrow pieces. Here the writer tests surface of completed piece with a straightedge.

Now number each piece at one end with matching numbers *(Fig. 1)* and you are ready to carry the stock to the jointer and joint the edges straight.

On each cut, *keep the numbers to the front (Fig. 2)*. By doing this you need not worry whether the jointer fence is dead square with the table. The reversal of each board with each cut automatically gives an angle supplementary to its mate and you wind up with a 180° joint and a perfectly flat finished board. Bear down on the back table and ease off as you near the end. This tends to give you a slightly concave edge that makes for a tight joint.

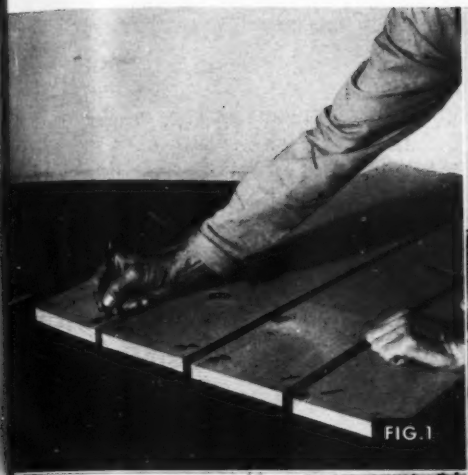


FIG. 1

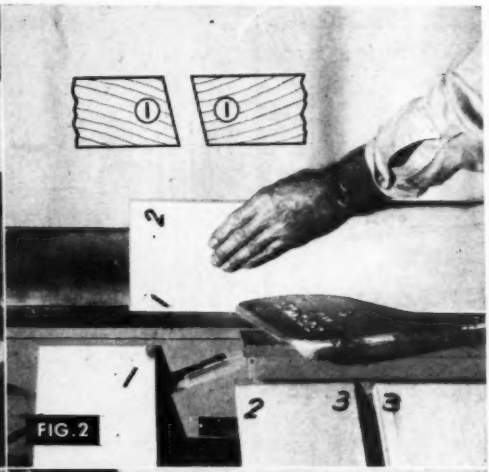


FIG. 2

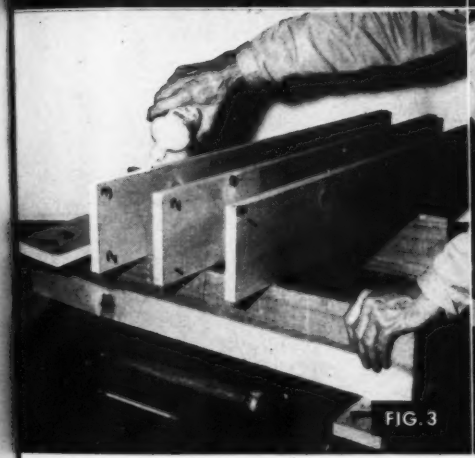


FIG. 3

FIG. 4

Next lay the boards on gluing supports. These should be 5″ or 6″ high so that you can turn the clamp handles easily—and they must of course be level. Turn all except the first board on edge and run a bead of glue along each edge *(Fig. 3)*. Some workers make a habit of applying glue to both surfaces, but I have found that one fair-sized bead is sufficient. Even with only one bead, the glue squeezes out on both sides.

Rub adjacent joints endways a bit to get good contact. Apply a clamp about in the middle, checking to see that the edges line up. Then hammer in pinch dogs *(Fig. 4)*, one straddling each joint.

A couple of dozen of these pinch dogs (you can get them at patternmaker's supply stores) make unnecessary a heavy investment in clamps. The angled inner edges draw the joint tightly together as the dog is driven. Drive them either into the ends or backs of pieces being joined. Using them, you can get by with a clamp every three or four feet. Set the clamps alternately at top and bottom to balance their pull.

Wipe off excess glue when the dogs have been driven. After the glue has set pry out the dogs and clean up the piece.

And right about then, you'll feel that you really have built something. END

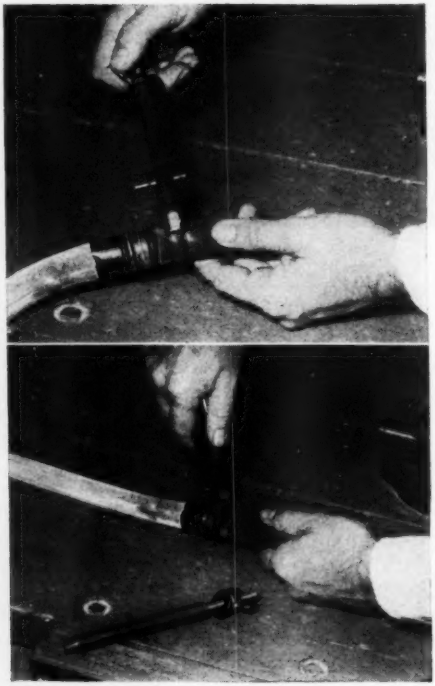
Downspouts Form a Supply Rack

You can make a holder for dowels, drill and welding rods by nailing several lengths of downspout to a square of ¾" plywood. Fit and nail a disk of wood in the bottom of each tube and screw them to the square base. Bind the tops together with a length or two of wire.—*Daniel I. Hadley, New Castle, Del.*

Wood Block Gauges Depth

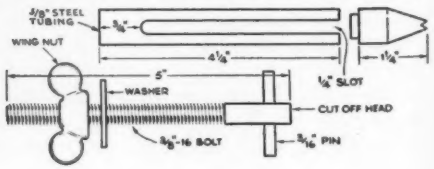
A BLOCK of wood slipped over a bit enables you to drill holes of uniform depth. The projecting end of the bit will determine the depth of the holes.

How to Make Jig for Bending Hose Clamps Out of Wire

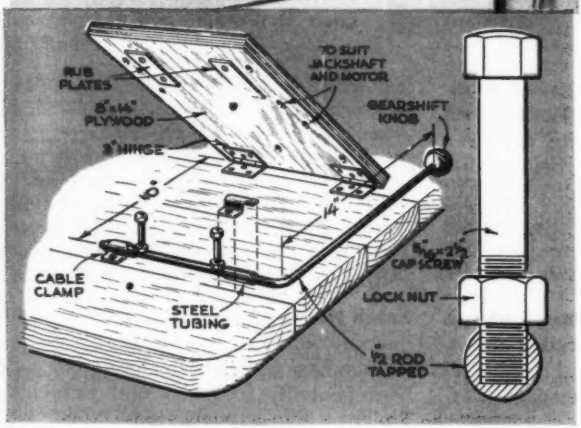


USING a homemade jig, you can bend hose clamps out of wire. Shape ⅝" bar stock to form a notched tip, as shown in the drawing, and weld or braze it to ⅝" steel tubing which has been slotted to take a sliding pin. Cut the head from a ⅜"-16 bolt and drill that end for a drive fit for the pin. Then assemble in the tubing, drive the pin in, and thread on a washer and wing nut.

In use, wire shaped into an elongated U is twisted around the hose and the ends passed through the loop. While the notched nose of the jig engages the loop, the wire ends are twisted around the pin and each other (upper left). Turn the wing nut to put on tension, bend the jig around the loop, snip off the wire ends (bottom), and flatten with a hammer.—*M.C. Anderson, San Lorenzo, Calif.*



New Shop Ideas

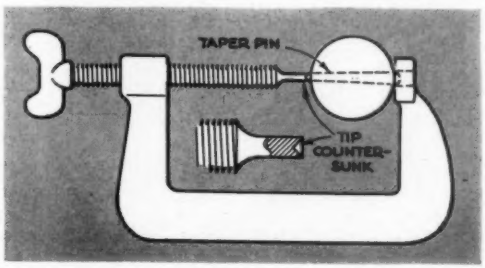


Tilting Base Is Lathe Clutch. This tilting jackshaft base provides a clutch by which a lathe can be stopped without shutting off the motor. It also makes it easy to shift the belt, and maintains driving tension even after the belt has stretched.

The base shown consists of two ¼" steel plates, with bits of steel tubing welded on to form the hinge and the lever mount. Two 2" pieces welded to the lever lift the top plate. They are rounded at the ends so as not to gouge it.

As shown in the drawing, a base of ¾" plywood could be hinged directly to the bench top, and the operating lever could be built up instead of welded. The weight of the jackshaft supplies belt tension. To lessen it and dampen vibration, place some sponge-rubber padding beneath.—*M. C. Anderson, San Lorenzo, Calif.*

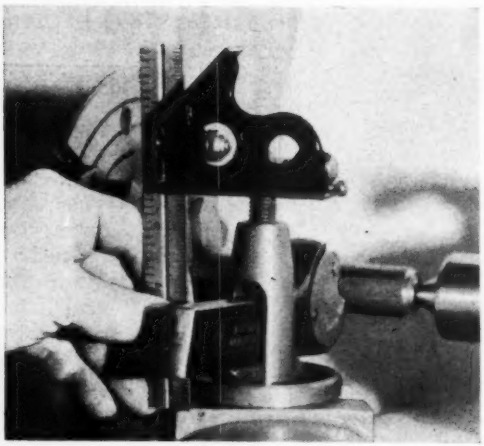
C Clamp Drives Out Pins. By taking the foot off a C clamp, you can adapt it to press out taper pins. Countersink the screw end with a small drill and grind or turn it smaller than the little end of the pin. Drill a hole through the solid jaw of the clamp so the pin will have an exit to pass through.—*Hugh Lineback, Stillwater, Okla.*



Please turn the page for more shop tips

More Shop Tips

Rubber Grips Save Hands. The sharp knurling on die stocks and tap wrenches can be rough on the hands if the tools are used for long periods. Ordinary tricycle handle-bar grips make comfortable nonslip handles for such tools. The grips are available in several different sizes.—*H. J. Gerber, Stillwater, Okla.*

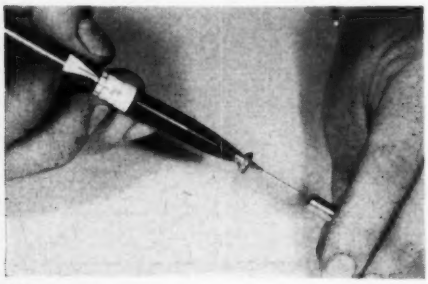


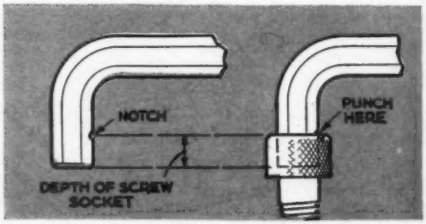
Level Checks Tool-Holder Tilt. A common cause of imperfect knurls, poor threads and rough cut-off jobs is a leaning tool holder. Wear or warpage in the rocker or tool-post washer will pull the tool holder out of plumb.

Provided the lathe is properly leveled, you can use a combination square to check this. Hold the blade against a smooth portion of the holder. If the bubble in the head is not centered, replace bad tool-post parts or use a piece of bar stock to replace the rocker and washer for work requiring a plumb setting.—*Glen M. Larsen, Santa Ana, Calif.*

Pencil Acts as Depth Gauge. A good-quality mechanical pencil, loaded with stiff wire instead of graphite, makes a direct-reading depth gauge (below) that you can carry in a pocket. Solder a small washer on the tip as a gauging stop.

Measure the distance that the wire moves in one turn of the cap. Scale off the circumference of the barrel in suitable divisions of this distance, and put an index line on the part that turns. Count the full turns; then add the partial one that is indicated by the scale.—*Phil McCafferty, Stanwood, Iowa.*





Notch Holds Wrench in Socket. On production work, it saves time to leave a wrench in a socket-head screw that must be repeatedly loosened and tightened. To keep the wrench from falling out, grind a notch in it as above, and center-punch the top of the screw into the notch.—*Frank LaSaracina, New York City.*

Wax Identifies Screws. In many drill jigs and fixtures, some screws hold integral parts together, while others must be repeatedly loosened to insert work. Turning the wrong ones wastes time and may impair accuracy. To prevent this, fill the heads of permanent screws with wax.

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Kodak Color Films above are now priced without the cost of processing included.

Eastman Kodak Company, Rochester 4, N. Y.

Kodak

Gus Meets a Flood of Trouble
[Continued from page 192]

shove the front end around, or push it up the incline if they did, for a glance at the rear springs had told him that the enclosed body was heavily loaded.

"Take it easy, mister," Gus said to the driver. "These folks just want to get home."

"Have them stand clear then," the driver growled.

Gus stood in the shelter of the underpass watching the trucker try to start the motor. He hopped back and forth between the upflung hood and the cab, standing on the starter frantically to no avail.

"You polliwog," the irrepressible Tom Hanratty told him. "Why not let Gus work on the thing—he's the best mechanic in the valley."

"Is that so," the trucker said warily. "Maybe you think you can do better—eh, Wilson?"

"Maybe so," Gus told him, stepping forward. "Maybe not."

Looking at the motor with his flash beam Gus realized that he was going to have a time getting it started. The spark-plug depressions were brimful of water.

Water glistened at spark plug, coil and distributor terminals. What worried Gus the most was the cracked and weathered condition of the old ignition cables.

HE BLEW away all the water he could with his tire pump, made a mental note of the positioning of No. 1 wire in the distributor cap and then yanked the wires loose. He carefully wiped the primary and secondary wires as dry as possible, forced a dry corner of his cloth down into terminal connection cups on plugs, coil and distributor cap, wrung it around with a small screwdriver blade. Fearing condensation, he held the flame of a match inside the distributor cap itself. Replacing the wires in proper firing order he backed out from the hood. He moved swiftly and was behind the wheel, reaching for the ignition key before the trucker realized it.

"Climb out of there," the trucker snapped at Gus. "I'll try her myself."

"It's your baby," Gus said, shrugging his shoulders and getting down.

When the motor didn't start, Gus lifted the hood with his light off. He saw a telltale wriggling of spark flame at the distributor cap and where the wires went through a bracket at the block. A man could work on this motor all night in this rain, he told himself grimly, and not get it dry enough to start.

"So," the driver said, coming down out of the cab to waggle a finger under the startled nose of Tom Hanratty, "this Wilson character is so good? Now both of you clear out before I—"

"You blue-nosed idiot," Hanratty yelled. "Why don't you keep your fool trap shut long enough for Gus to think?"

FOR a moment there, Gus thought that the trucker was going to commit assault and battery on the irate old codger. Gus hesitated long enough to see that he wasn't and then ducked under the hood again. Let's see now, he thought, electricity always follows the least line of resistance. That spark jump at the wires indicates it is finding it easier to jump there than across the gap of the spark-plug electrodes. There's no chance of getting the wires any drier. Now how about reducing the spark-plug gap to make it easier for the spark to flow there? It seemed a good thought to Gus, so he took out the plugs and reduced the gap from the factory-recommended 25 thousandths of an inch to a bare eight or ten thousandths.

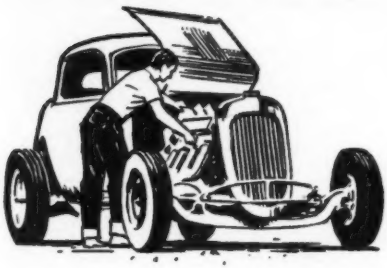
"Try her now," he told the trucker, after replacing the plugs.

The motor turned a few times, backfired, ran raggedly, then settled down to work.

"Now," Gus said, and his words carried a note of command, "if you can weasel her out, we'll pull the Chrysler out before you take off."

By the time the truck driver had the truck lined out Gus had his tow cable

[Continued on page 246]



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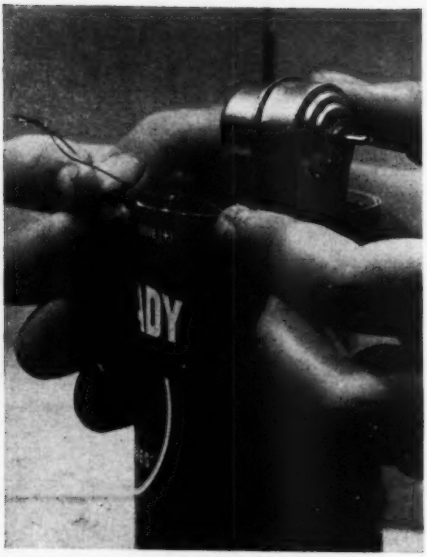


Mite Puts Out 10,000 R.P.M.

HITCHED to flashlight batteries or to a 1.4-volt dry cell, this midget Japanese motor will deliver up to 10,000 r.p.m. to run hobby models, games or displays. Moen Trading Co., 225 West 34th St., New York City, prices it at 89 cents.

Plane Shadow Blueprints House

AS HE was flying in an airliner some years ago, Talbert Abrams of Lansing, Mich., watched the plane's shadow speed over the ground. "What an idea for a house," he mused. Today it is a reality. It even has curved plastic windows.

Gus Meets a Flood of Trouble

[Continued from page 244]

attached to the Chrysler, so that the trucker had no choice. The Chrysler started as it was towed out, and a few minutes later was on its way toward town. The Ford started under its own power. Soon the remaining cars were easing through the two feet of water and a highway crew arrived to take over the situation.

WHEN Gus came to the first street lights of town he saw that the truck had been stopped by Jerry Corcoran's police car. As Gus pulled up, Corcoran greeted him with a smile.

"The Chrysler driver," he told Gus, "gave me your message. What gets me, Gus, is how you knew that this truck had been stolen."

"I didn't know," Gus told him. "In fact, I wouldn't have even suspected it if the driver hadn't acted so peculiar. When you do a man a favor you expect him to be sort of appreciative. When he isn't, something smells suspicious. When I nosed around and found a jump wire on the primary circuit and no key in the ignition switch, I thought maybe you'd better take a look at it. What gets me, Jerry, is why should a man bother to steal an old-model truck like this?"

"That's easy to answer," Corcoran said. "The truck isn't worth stealing, perhaps, but the cargo is. That van is loaded with expensive electric appliances from an upstate wholesaler, on their way to market."

"What do you know!" Gus exclaimed. "And this character would have gotten away with it if he had just thought to use a little courtesy."

"And I suppose," the trucker said sarcastically to Gus as Corcoran slipped the handcuffs on him, "you're always courteous."

"You said a mouthful then, mister," Corcoran told him. "You look awfully wet. Suppose we take a ride down to our nice, dry jail. We've been on the lookout for you for some time." END

NEXT MONTH: Gus cools off a hot rodder.

Texaco Tips On Car Care

If one of your lamps burns out at night...

and there isn't a nearby station to replace it, put white reflecting tape across the lamp in a criss-cross position. By reflecting the rays of oncoming lights, it indicates the outline of your car. Carry a small quantity of this tape with you for such an emergency. Another good tip—be sure to keep your headlights clean. Surprisingly, a single day's accumulation of dirt may cut their effectiveness as much as 50 per cent.

If your car feels like this...

it's time for *Marfak* chassis lubrication. *Marfak* is what you get—always, at no extra cost—when you get your car lubricated by a Texaco Dealer. It's the famous lubricant that lasts for a thousand miles or more — delivers more miles of *cushiony*, comfortable driving. So forget rough going! Get *Marfak* chassis lubrication today. See your Texaco Dealer, *the best friend your car has ever had!*

TEXACO DEALERS IN ALL 48 STATES

Texaco Products are also distributed in Canada and in Latin America

THE TEXAS COMPANY

TUNE IN: TEXACO STAR THEATER starring JIMMY DURANTE, on TV Saturday nights, NBC. Metropolitan Opera radio broadcasts Saturday afternoons, ABC. See newspaper for time and station.

Atomic Rays Keep Food Fresh

[Continued from page 104]

and are following up promising ideas: freezing the foods first, excluding oxygen during irradiation, or adding various preservatives.

Whether or not they eventually succeed in totally sterilizing a beefsteak, they see early and interesting possibilities short of that:

Plans are nearing realization to give meat, fish and vegetables a "pasteurizing" dose of 50,000 to 1,000,000 roentgens of radiation. This wouldn't be enough to affect the food's flavor, or totally sterilize it either, but it would knock off the bacteria that were on the surface.

Then a piece of meat would keep, in a refrigerator, five or 10 times as long as usual. There's a chance that meat irradiated this way may be on the market before the year is out.

Radiation in still smaller doses suffices for special applications that look nearest of all: destroying trichina parasites in pork, ridding grain of insect pests, checking stored potatoes' sprouting.

Irradiation may also be linked with other processes. Natural enzymes of meat and vegetables adversely affect a few foods' keeping qualities. While the enzymes are immune to radiation, a supplementary treatment—mild heat or blanching—inactivates them.

Irradiated foods may be sold in heat-sealed bags of polyethylene plastic, ray-treated right through the bags. No doubt they'll also be put up in cans, and any other containers that can be hermetically sealed to keep bacteria out.

Which source of radiation will win out, no one knows yet—they're trying them all.

Trials have used deep-penetrating gamma rays from reactors' uranium-fuel rods, from radioactive cobalt and from waste fission products, the "ashes" of atomic furnaces. Now the Department of Defense, with AEC help, is building a special atomic reactor to irradiate food. You can't do it with existing reactors because their neutrons could make the food radioactive; but there are several ways to design a new one that will expose food to gamma rays only. Neither these, nor electrons of not-too-high energy, induce radioactivity in food.

Electron beams penetrate less deeply than gamma rays, but have points in their favor. You can turn them off at day's end, or to make repairs—something you can't do with radioactive sources—and less shielding is needed for protection. They come from a million-volt General Electric machine called a resonant transformer; from others with such names as Van de Graaf, Capacitron, Genetron. A relatively new concern, Applied Radiation Corp. of Walnut Creek, Calif., has come up with an interesting type called a linear accelerator. Recently Arco completed one that will fit right into a regular processing plant, where heat is used now, for a Rockford, Ill., maker of food-processing machinery. It can totally sterilize two tons of food an hour, or pasteurize from 20 tons to several hundred hourly.

You know that a woman still loves her husband if she suggests that he can use more room in her clothes closet.
—THE SIDEWALK SUPERINTENDENT

The Defense Department itself plans a 1,000-ton-a-month food-irradiating plant by 1958—a pilot-scale prototype for commercial ones. The idea is that near to becoming big-time.

The green light for such projects will be approval of irradiated food by the Pure Food and Drug Administration. First it must be absolutely satisfied that no hazard, known or unknown, lurks in food exposed to radiation. To that end, the experimenters have fed irradiated food to mice, rats, chickens, dogs and monkeys. All thrived. Now volunteer human subjects have been living on irradiated-food diets for nearly a year. To date, the reports are favorable, with the final ones due soon. END

Why grope your way like this in fog?

Get a pair of G-E *All-Weather* Headlamps... see better in any weather

NEW General Electric *All-Weather* Headlamps are so revolutionary they make all ordinary headlamps obsolete.

With ordinary headlamps, upward light is uncontrolled. This light is reflected back into your eyes by millions of tiny moisture particles —that is why seeing at night in fog, rain, or snow, is so difficult. New G-E *All-Weather* Headlamps have a special shield over the lower beam filament that blocks out uncontrolled upward light. Kick-back glare is reduced to a minimum . . . you can see the road ahead more clearly.

Ordinary Headlamps: Uncontrolled upward light bounces off moisture particles, causes kick-back glare, blinds driver.

G-E *All-Weather* Headlamps: G-E filament shield controls upward light, reduces kick-back glare, makes seeing easier.

On clear nights, the upper beam filament which is purposely not shielded, puts light farther down the road. You can see curves, dips and obstacles in time to slow down.

With a pair of G-E *All-Weather* Headlamps you get 25% more light. Passing oncoming cars is easier, too, because the light is concentrated where you need it — on the right-hand side of the road.

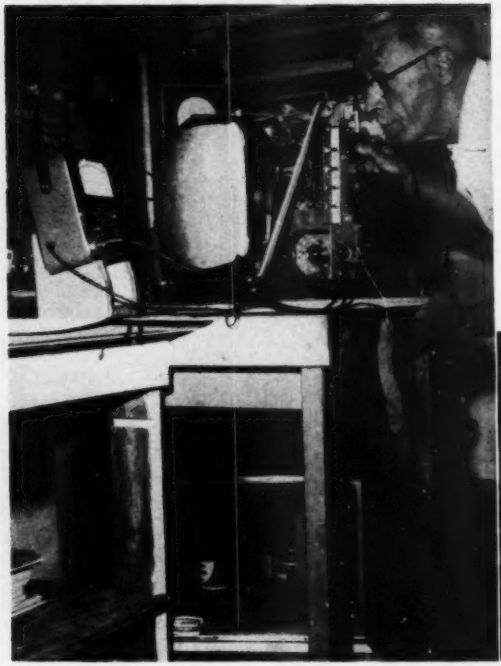
Replace your present headlamps with a pair of new G-E *All-Weather* headlamps. They can be quickly installed and accurately aimed for a surprisingly modest cost. Ask for them by name: G-E *All-Weather* Headlamps.

Miniature Lamp Dept., General Electric Co., Nela Park, Cleveland 12, Ohio

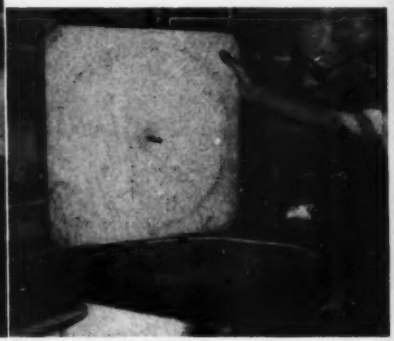
Progress Is Our Most Important Product

GENERAL ELECTRIC

Roll-Away Square Benches Provide Extra Work Space



BY DIVIDING his workbench into 3'-square sections mounted on casters, this TV repairman always has a bench available for a television set. When one is tied up, he rolls it out of the way. Each table top is fitted with a revolving plywood platform, as shown below. A bolt serves as a top shaft and four casters act as bearings. When he wants a long workbench, he just rolls them together.—*Don Stanley, Sarasota, Fla.*



Heated Dowels Make Tight Fit

HEATING a wood dowel with an ordinary infrared lamp, or in an oven to about 300° F., will drive out moisture and shrink it enough to fit into a slightly undersize hole. It's a faster method than sanding and, besides, reswelling after a dowel has been glued into its hole will give you a much tighter fit.

Fertilizer Bags Protect Plants

EACH fertilizer or phosphate bag you empty can protect two young plants. Cut open the bottom and divide the bag in two; then set each half around a plant, digging it about 4" under the soil and propping the corners with stakes. Any plant food left will wash into the earth.—*E. V. Reyner, Townsend, Mont.*

WARNING!

Today's high-powered engines need frequent spark plug checks to prevent dilution of oil

Don't change to summer oil without a spark plug check!

If you haven't checked your plugs in the last 5000 miles, they may be misfiring—and will dilute your new oil with gasoline.

Do you realize that every time a spark plug misses, raw gasoline remains in the cylinder and drains into your crankcase? This thins the oil so it can't properly protect costly engine parts . . . and may put you in line for a big repair bill.

So replace winter-worn plugs with new 5-rib Champions *before you change to summer-grade oil!* Champions will protect your oil from dilution. What's more—they'll give you greater horsepower and better gasoline mileage.

Ask your serviceman to check your spark plugs today. If you need new ones, insist on 5-rib Champions—the finest money can buy.

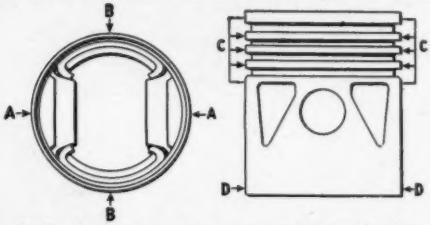
To get full engine power . . . drive in where you see this sign

Care and Feeding of Engines

BY S. P CORP

CONCERNING PISTONS

The piston's job is to transfer the force of combustion into rotary motion through connecting rod and crankshaft. To do this, it must support the rings that seal combustion. Most pistons today are of aluminum alloy, to reduce the load on connecting rod bearing.



Diameter A should be .010" to .012" less than diameter B.

Diameter C should be .0005" to .0015" less than diameter D.

The piston is elliptical in shape to allow for expansion and to control side thrust on cylinder wall as piston gets hot in operation, when it becomes round. All pistons must be fitted to specifications, using a feeler gauge on the B dimension. The top is narrower than the bottom; always measure about ½" up from bottom.

When fitting new rings to old pistons, inspect to see that ring lands are square. A worn top land will prevent a new top ring from sealing properly. The Sealed Power GI-60 Insert is the best means of correcting this condition, permanently and economically.

CARBURETOR AIR LEAKS

A carburetor air leak may cause hard starting by making mixture too lean. To check, connect a vacuum gauge to intake manifold, removing air cleaner from carburetor and high tension wire from coil. Have someone step on starter. Place hand over carburetor so air can't enter. Gauge should show 12 to 14 inches of vacuum. If less, remove carburetor and repeat test with hand over intake manifold. If reading is still low, replace manifold gaskets. If second reading is above first, look for leaks in carburetor body or at throttle valve shaft. Check all gaskets—between air horn and float body, between float body and throttle body, and the main gasket at bottom of carburetor.

FREE BOOKLET FOR YOU

This illustrated booklet contains a world of valuable facts about car care. It's yours for the asking. And be sure to use Sealed Power KromeX Ring Sets when you re-ring—for easier starting, for greater oil economy, and for double ring life. Your dealer has them or can get them for you. Sealed Power, Dept. H-4, Muskegon, Michigan

Sealed Power

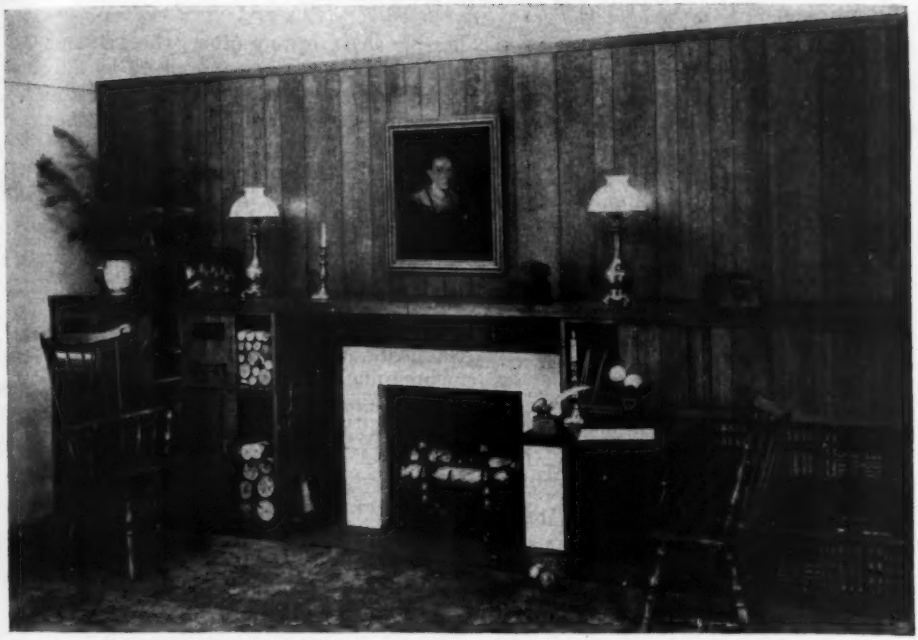
PISTON RINGS

Peanut Bulbs Pack More Light

MORE oxygen inside gives these two new tiny bulbs for the box-camera amateur increased light for his flash shots. The clear GE PowerMite M2 at left will light subjects up to 36 feet away for fast black-and-white film. The blue bulb at right is for color, at up to 12 feet.

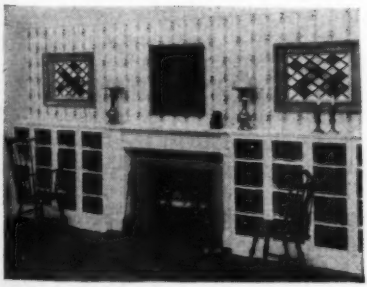
Sky Railroad Tests Rockets

SMALL test sleds skimming along this aerial track at supersonic speeds represent jet planes. When they near the end of the 600-foot run, experimental aircraft rockets are launched—slamming into a hill six miles away from the installation at Redstone Arsenal, Ala.



See what Weldwood V-Plank can do! Warm cherry transformed the drab scene (below) into this picture-book family room. And all the V-Plank shown, including facing those practical built-ins, costs only $105.

See how you and wood panels can make a room lie about its age



Before Weldwood, here's what this fireplace wall of a 35-year-old house looked like.

Here's a 1920 living room with 1956 ideas. Look how Weldwood Cherry V-Plank panels helped make it warm, cheerful and more livable. New built-ins tell you this is a room for *today's* living. At right: a handy desk-bookcase unit. At left: a neat nook for kindling and logs, plus a home entertainment center.

You and Weldwood paneling can do the same in your home. See pre-finished V-Plank and other paneling at your lumber dealer's, or at any of our 87 offices in principal cities. Or send coupon for booklets.

Choose from 6 fine woods in Weldwood V-Plank*: walnut, $85; Korina®, $79; mahogany, $79; Samara*, $52; cherry, $79; prices are for a wall 12′ x 8′.

Weldwood® Paneling

A product of

United States Plywood Corporation

WELDWOOD—The Best Known Name in Plywood

In Canada—Weldwood Plywood, Ltd.

*Trademark

United States Plywood Corporation
Box 61, New York 46, N. Y.

( ) Enclosed is 10¢ for full-color 20-page book of home decorating ideas, "Beautify Your Home with Weldwood Paneling."

( ) Enclosed is 25¢ for 40-page book "Do It Yourself with Weldwood Plywood," plus directions for making desk and turntable-compartments shown above. PS 4-56

Name.....

Address.....

City.....State.....

How to Use Abrasive Wheels Safely

[Continued from page 209]

flanges smaller than 2". You can keep the point in mind when buying a portable electric saw. Their flanges are fine for saw blades, but too small by code standards for a cutoff wheel.

At present the right flanges for home workshop machines are almost impossible to come by. Don't improvise by using flat washers. Never use two flanges of different size. Until better flanges are available, better use the ones provided and minimize their defects by careful attention to other details.

Blotters, for example, are meant to act as cushions, absorbing minor roughnesses in the clamping surfaces. They must be bigger than the flanges. If they are too small, frayed, or torn, carefully peel off every scrap and paste on new ones cut from a thin desk blotter.

Tighten the arbor nut snugly, but don't lean on it. Excessive tightening can distort the flanges, as shown in one of the drawings. If you can slip a thin feeler gauge under the outer edge of a flange, then the arbor nut is probably turned too tight.

Keep your guard up. If a wheel should burst, nothing may stand between you and serious injury except the guard. This unexciting piece of equipment is usually a drum or band surrounding all but 90° of the wheel, with end covers.

Polishing heads, being meant for wire brushes and cloth wheels, have no guards. Resist the temptation to mount grinding wheels on such heads. Do not improvise guards out of coffee cans, sheet metal and similar materials that aren't husky enough to contain the flying pieces of a shattered wheel.

You can buy arbors for wood lathes and combination tools, but not guards that would make it safe to use a grinding wheel on them. The accompanying photos show two sturdy homemade guards that will provide protection. Be watchful of wheel speed on machines with belt shifts; their top speed may be too high for abrasive wheels.

If you must use an electric drill, a flexible shaft, or any other wheel mount without a guard, protect yourself by limiting such use to a 3" wheel (not the popular 4" size) run at no more than 3,700 r.p.m. Wear goggles; be careful not to exert side pressure on the wheel. Stand aside, out of line with the wheel.

Make safety a habit. Don't use a grinding wheel that you know has been dropped. Never stand directly in front of a wheel just after you start it. Be sure tool rests and guards are securely clamped. Avoiding jamming work into or bumping a wheel.

Where to use cutoff wheels. Buy only reinforced cutoff wheels for home use. These are strengthened by cloth, glass fiber or nylon pressed into a resinoid bond. Do not confuse them with the older non-reinforced wheels or the depressed-center wheel designed for use with a special backing plate.

Reinforced cutoff wheels are so useful that the temptation to mount them without precautions may lead to trouble. Here are the tools you can use them on:

The portable saw. Although its flanges are rather smaller and its guard lighter than the ASA code approves, this is probably the best home tool for the purpose. It is especially good for cutting wide and bulky materials, such as corrugated sheets and masonry blocks. Guide it with two hands if possible. Don't let it wander or twist in the cut.

Saw attachments for electric drills, on the other hand, are worse than useless. Neither power nor speed is adequate, and the guard will not fit the wheel.

Bench grinder. If it has a proper guard and rest, a small cutoff wheel can be used on this for cutting rod or tubing, or for slitting plate stock. Take care to feed straight in, without twist. Never grind on the side.

Radial-arm saw. These are well guarded and the wheel is automatically kept in line with the cut. Clear away all sawdust before cutting metal (the spark stream is hot and heavy). A metal fence

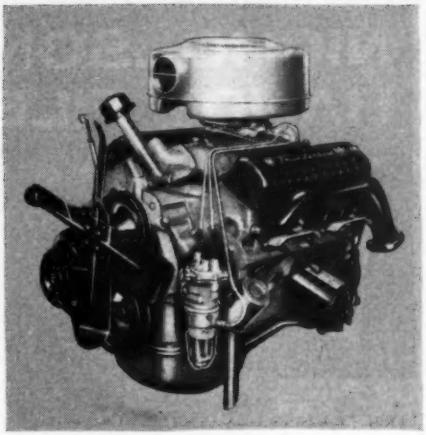
[Continued on page 258]

There is good news from Detroit for the man who appreciates the exciting feel of a lot of "horses" under the hood of his family automobile.

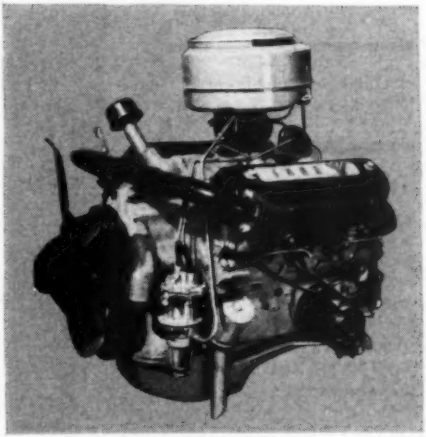
The management at Ford announced recently that its Thunderbird *Special* V-8, the job that revs up 225 h.p. and powers the mighty Fordomatic Thunderbird, now is available in Fairlane and Station Wagon models with Fordomatic Drive. This is the *biggest* engine in the entire low-price field with a displacement of 312 cubic inches! And it's number *one* in *torque*, too, which means you get top performance—for the kind of driving *you* do.

The standard V-8 engine for Fairlane and Station Wagon models already is the most powerful *standard* "eight" in the low-price field. It's the Thunderbird V-8 that develops 202 h.p. with Fordomatic. This is up to 32 *more* horsepower than other standard V-8's in Ford's field. What's more, this same engine has been made available in all Customline and Mainline model Fords, too.

What all of these power boosts amount to was perhaps best expressed by the automobile mechanic who, upon hearing of these new Ford engines said, "Looks to me like Ford means to stay Number *One* on the 'Git' Parade!"



The 292-cubic inch Thunderbird V-8, the standard eight for all Fairlanes and Station Wagons, is now available in all Customline and Mainline models, too. Has 4-barrel carburetor, dual exhausts.



The 272-cubic inch Ford V-8, the standard eight for all Customline and Mainline Fords. Has modern dual carburetor, automatic choke, single exhaust.

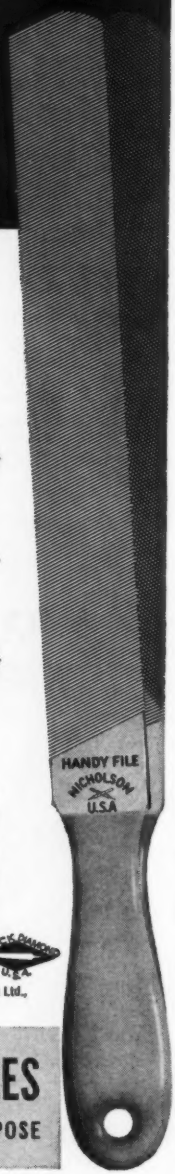
FORD Division of FORD MOTOR COMPANY

Hardware Week Special

NICHOLSON HANDY FILE only

69¢

(regularly 86¢)



You'll find it one of your most-used hand tools

- For household fix-ups
- For fast filing, smooth finishing on aluminum, other metals, wood, plastics

One side single-cut for sharpening, finishing

Other side double-cut for fast filing

Colorful, comfortable forged steel handle with hang-up hole

Buy several—for household, garage, workshop, sharpening garden tools—at this special low price during Hardware Week (April 12-21). Available at good hardware stores.

NICHOLSON U. S. A. NICHOLSON FILE CO. Providence, R.I. BLACKSTONE U.S.A.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON FILES

A FILE FOR EVERY PURPOSE

[*Continued from page 254*]

and asbestos table pad as shown in a photo are desirable. If the saw has a two-position switch, be sure it's turned on so that the exposed bottom part of the wheel turns *away* from you.

Circular saw. Grinding engineers shudder at this, for the circular saw is basically all wrong for abrasive cutting. The exposed part of the wheel turns toward the user. The guard is usually too light, open at the sides, or lifted too high when work slides under it.

What can be done to make it safe? The photos show how large concave washers, sold by a mail-order house for stiffening thin saw blades, can be adapted to a cutoff wheel. Although they reduce the depth of cut you can take, they are preferable to the regular saw flanges.

A husky guard deflector made from ordinary angle iron is also shown. It gives just about all the protection possible while leaving the wheel accessible.

An optimist is a man who idles the motor in front of his house while he waits for his wife.

—THE SIDEWALK SUPERINTENDENT

Check your own saw, if you intend to use it, for exposure to the wheel under and behind the table. Some tilt-arbor castings virtually enclose the wheel underneath. Keep onlookers away while you do abrasive cutting.

A flat "don't" is the only good answer to using cutoff wheels on a drill press, flexible shaft, electric disk sander and other portable tools. It is almost impossible to provide a guard on such machines, and being hand-held, they impose severe side pressure on a wheel.

For the same reason, no grinding should ever be done on the side of cutoff wheels even if they are mounted on a rigid spindle. Inspect the edge of cutoff wheels occasionally during use; if they wear to a taper, they may bind in a cut. Dress the edge square with a piece of an old wheel or a dressing stick. END

"Rochester Carburetors Treat Us Right!"

Any "fuel" knows it . . . you can't beat a Rochester Carburetor for feeding fuel to a modern engine. Every gallon's a long gallon—every gallon's a "go" gallon—when Rochester is the go-between. So stretch out your mileage between station stops—specify a gas-saving, money-saving Rochester Carburetor every time. Original equipment for Cadillac, Buick, Oldsmobile, Pontiac and Chevrolet cars.

CARBURETORS BY ROCHESTER PRODUCTS

ROCHESTER
PRODUCTS
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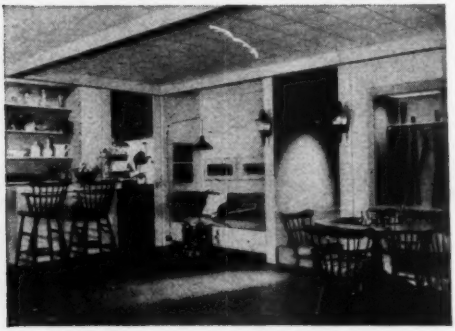
GENERAL MOTORS
CORPORATION
ROCHESTER N.Y.

Turn your basement into a FUN-AND-HOBBY ROOM for only 16^{00} a month!*



It's easy to do with Gold Bond Building Products

Build a room like this in your basement—or in *any* waste space. It's a cinch with Gold Bond Building Products . . . made to *work together.*

Strong, sturdy walls are Gold Bond Gypsum Wallboard. Big, lightweight panels are easy to apply. Simply saw like lumber, or score with a knife and snap off. Conceal joints with Gold Bond Tape Joint Treatment.

On the ceilings use Gold Bond Insulation Tiles. Quickly applied; interlocking edges hide nails or staples.

Finish with Gold Bond Velvet—world's finest latex paint. Goes on with brush or roller, dries in minutes, washable. Clean equipment with water.

See your local Gold Bond Dealer for all building, remodeling materials.

NATIONAL GYPSUM COMPANY
Buffalo 2, N. Y.

* Based on cost of materials spread over 36 months. Prices vary slightly in some localities.

MAIL COUPON TODAY

National Gypsum Company,
Dept. PS 46, Buffalo 2, N. Y.

Please send me Gold Bond "How-to-Do-It" Plan #18 showing me how to build a basement fun-and-hobby room. Enclosed is 10¢ to cover mailing.

Name_____

Address_____

City_____ Zone____ State_____

[*Continued from page 141*]

activities transferred to the do-it-yourself room and family room, the living room is likely to be in good order for any unexpected visitors. If it isn't, the living room can always be picked up quickly and the other rooms left alone. You can't see them from the living room.

None of the windows or doors is over six feet eight inches high—low enough for washing without a stepladder.

Plenty of storage. This home has eight clothes closets, plus a broom closet, linen closet for bath linen and a second linen closet for bedclothes.

Plenty of baths. Counting the lavatory off the do-it-yourself room, there are three in this plan. They are convenient to living room, bedrooms and (for guests) the front hall.

Companionship for your wife. While you can have the boys in the workshop, Mom's kitchen is so planned that she can be with, or watch, the children. They may be in the play yard, which she sees through her kitchen windows. Or they can be in the family room, in plain sight over her kitchen counter top.

Quiet sleeping areas. No matter what's going on in this home, there is peace and quiet in the bedrooms. Halls, walls, closets and distance insulate the sleeping wing from noise.

Glass walls. When they can't get outdoors, Americans like to look out. The PSM house has a glass wall across the dining and living rooms, facing your garden, as in the best modern houses.

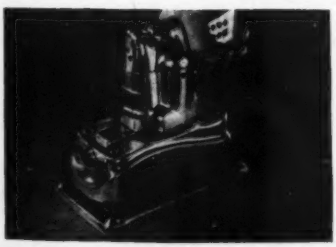
Matern expects people to ask about excessive sun heat admitted by this long glass wall. He points out that there is an eight-foot roof overhang to reduce the temperature—and glare, as well.

The cost of the house is difficult to predict, Matern says, because building is twice as expensive in some areas as in others. But he estimates that this house, containing about 1,500 square feet of living space, might range between $19,000 and $35,000. END

NEXT MONTH: How to replace those broken sash cords.

Special during Hardware Week—April 12-21

this NEW Black & Decker ¼" Drill... makes your home repair jobs easy!



NEW Orbital Sanding Attachment
for B&D ¼" Drills . . . gives professional finishes! **Only $16.95**

Use this new orbital sanding attachment . . . with, across or against the grain! Get a satin-smooth finish like never before. Big bottom plate extends beyond housing —sands right up to obstructions. No swirl marks; no chance to ruin the job! Amateurs do perfect work with this wonderful new sanding attachment. And any B&D ¼" Utility Drill has plenty of power to get your sanding done faster!

Over 2,500,000 homeowners now do *their own* repair and building jobs with Black & Decker ¼" Drills—world's most famous do-it-yourself tool! This new, powerful, lower priced drill handles like a charm—with attachments to drill, saw, sand, drive screws, mix paint —any home application you can think of. Make your own lawn chairs, end tables, children's furniture! Polish tables easily, quickly—sharpen garden tools—clean rust off metal railings!

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LOOK IN THE YELLOW PAGES UNDER "TOOLS-ELECTRIC"

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WORLD'S LARGEST MAKER OF PORTABLE ELECTRIC TOOLS

Money-saving warning from **Purolator**

It's oil filter check time—now!

Save costly engine repairs! With your Spring oil change, ask for a FREE OIL FILTER CHECK!

A dirty, choked-up old oil filter can't protect your new summer-weight oil! So, ask your serviceman to check it *before* he puts in that new oil! If you need a new refill . . . insist on a genuine Purolator Refill.

The Purolator Micronic is up to 10 times more efficient than many oil filters . . . stops grit as tiny as 39 millionths of an inch! There's one engineered specifically for *your car*. Refills installed in minutes. Cost as little as $1.60.

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"Purolator" and "Micronic" Reg. U. S. Pat. Off.

Proved best for every make of car

PurOlator

OIL FILTERS

[*Continued from page 146*]

cracks, patch the roof, mend the floor covering and do other repair jobs.

A major problem still worrying the designers is what plastic to use for the wings. It may be a plastic sandwich with a core of styrene or urethane foam between two layers of fiber-glass-reinforced polyester. But they are not sure yet. A house may have to last 30 years; no structural plastic has been around that long, and nobody knows how plastic will take decades of sun or cold.

Joints pose another tricky question. Some plastics are easy to join to each other. The halves of the wing can probably be fused together on the site. Some parts can be molded without joints. But at MIT they are still trying to find the best methods of joining plastics to other materials. Also, some plastics "creep" and expand under heat. Elastic joints, special gaskets, nonhardening calking compounds or adhesive tapes may be needed to prevent the house from springing leaks on a hot day.

Some men who enjoy running things around the house are mighty proud of their power mowers.

—THE SIDEWALK SUPERINTENDENT

Will the plastic house be cheaper than conventional ones? That depends greatly on the materials. The house is designed for mass production, and the basic half-wing unit might be produced as efficiently as an automobile fender. And, as architect Goody puts it: "About 50 percent of the cost of a conventional house comes from labor on the site. With our design, we believe that we can reduce this item to about 15 percent."

Both Monsanto and MIT are emphatic about one point: The design is experimental. The first plastic house is most of all an "idea" house. Its main purposes are to find answers to questions that people will ask about plastic houses, and to demonstrate plastics as standard building materials. END

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"900" radial saw

. . . for small shops and home workshops

Delta's new "900" is the most powerful, most useful 9" radial saw ever built at any price! It's big, it's rugged—it does every job you ever wanted a radial saw to do. And it's the only 9" radial saw that gives you all these Delta "big saw" extras:

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Exclusive "Wide Bearing" Construction—Carriage rolls on extra wide spaced bearings for greater rigidity, years of more accurate service.

NATIONAL DELTA BUDGET PLAN

Get all the facts about the new Delta "900"! And get all the facts about the easy Delta Budget Plan: As Little As 10% Down...As Long As 24 Months To Pay! At all Delta Dealers' (under "TOOLS" in the yellow pages), and leading hardware stores.

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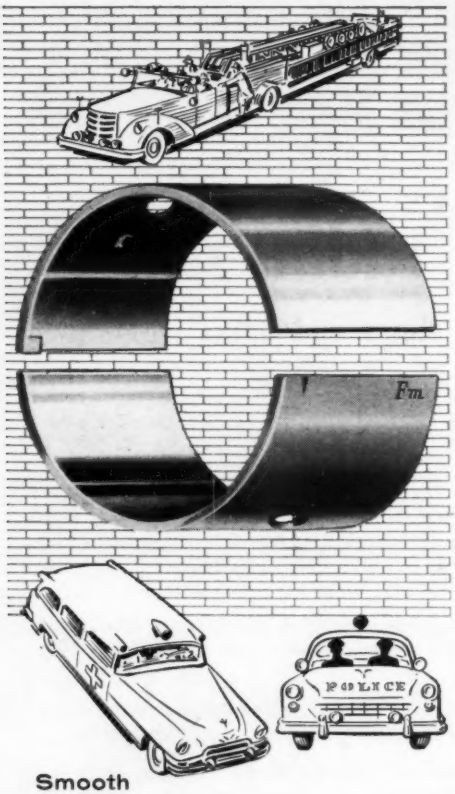

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tions are waiting. Installation requires elementary plumbing and wiring skill, but not more than that if you select a machine that can be hooked up easily—the type that pumps out waste is simplest to connect to the drain, for example. The pictures on pages 160 and 161 show you a typical installation.

If your dishwasher has an electric water-heating element, it needs a separate 110-volt line. Otherwise it can share a circuit.

Clothes washers (\$150 up) involve the simplest plumbing of all. It is all rubber hose, and you can get extra-long pieces if need be. The drain hose just hooks over a tub or sink.

> ***A woman never realizes how badly she needs an automatic dishwasher until her husband gets an unexpected raise.***
> —THE SIDEWALK SUPERINTENDENT

You will have less trouble if you give a clothes washer its own circuit—its starting load is high.

Clothes dryers come either as separate units or in washer-dryer combinations (which save space). The cost adds up to about the same. An electric dryer may cost from \$125 up. A gas dryer costs \$25 to \$50 more, but heats up faster.

Electric dryers generally need 220 volts; some also run on 110 volts but dry more slowly. A gas dryer has a ⅓-hp. electric motor that runs the blower and turns the drum. This calls for 110-volt service.

If your dryer isn't the new type that vents both moisture and lint down the drain, find out what does become of the discharge. Some dryers blow more than a gallon of water into the air every hour. This often condenses in walls and causes outside paint to peel.

All dryers can be converted for outside venting. Knockouts in cabinets permit quick attachment of a flexible duct made for this job. You run the duct through a wall to the outdoors and cover it with a cap that comes with it. END

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KIMSUL INSULATION — A PRODUCT OF Kimberly-Clark

Kimberly-Clark Corporation • Neenah, Wisconsin

Overhauling Your Lawn-Mower Engine
[*Continued from page 232*]

for removing head bolts. There seemed nothing wrong with the gasket. Putting it aside, Cam put the head on the block and tried to slip the thickness gauge in between at various points.

"Not warped," was his verdict. "Put grease on that gasket and try it again."

Smearing both sides lightly, I replaced gasket and head, put the torque wrench on, and tightened the first cap screw. Then I tackled the next.

"Hold it!" snapped Cam. "That how you tightened it last time?" I nodded.

"That'll do it," Cam went on. "Tightening head bolts circlewise puts uneven stresses on the head. It can't expand evenly when hot, and you get leakage."

A bet pays off. Skipping across from bolt to bolt as Cam showed me, I had the head tight and the engine running in five minutes. Shortly after, a muted roar from the cellar signaled Bud's success in starting his two-cycle.

That evening I went to Cam's to return a can of grease I'd borrowed.

"Bud just phoned," said Cam. "He's got his first contract customer."

"Good for Bud," I said glumly.

"What's eating you? You won that bet with Madge, didn't you?"

"Well—not exactly. Madge stopped in a store after leaving the theater. She says if she *had* come right home instead of shopping, I wouldn't have had the mower running. Which is true."

"So what? You have some new tools, learned some tricks and got the mower started. Isn't that worth the price of the new hat you bet her?"

"Guess so," I admitted. "What hurts is that it was a millinery shop she stopped at. She wore the hat home." END

A Word to the Wives

A man was suing his wife for divorce. The judge asked what grounds he had.

"Judge," he answered, "she just talks and talks—all day."

The judge inquired, "What does she talk about?"

The reply was, "She don't say."

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[Continued from page 184]

and stir until they turn into liquid and are thoroughly mixed. You can also tint white and colored paints with ordinary oil colors in tubes. The one exception is a new white dripless exterior house paint (made by Superior) that is not intended to be tinted.

Some makers offer their dripless paints in "low odor" varieties, just as they do standard types. You also have a choice of standard finishes—flat, semi-gloss or gloss enamel. You can even get special trim and sash paints.

Prices run about the same as for similar standard paints. The alkyd wall paint that we used on our living-room walls cost about $5 a gallon.

Using the paint. In hot weather, you may have to put the can in the refrigerator for a few hours overnight to make sure that the paint is firmly jelled. In any case, keep it stored in the coolest part of the house.

Under very warm conditions, you may also notice a thin layer of oil on top. Give the paint a good stirring, then let it jell again. Don't thin the paint unless you happen to leave the lid off and it becomes excessively thick.

If old surfaces are firm and smooth, you can paint right over them. If not, prepare them as for ordinary paints. Prime new wood surfaces with a regular undercoater.

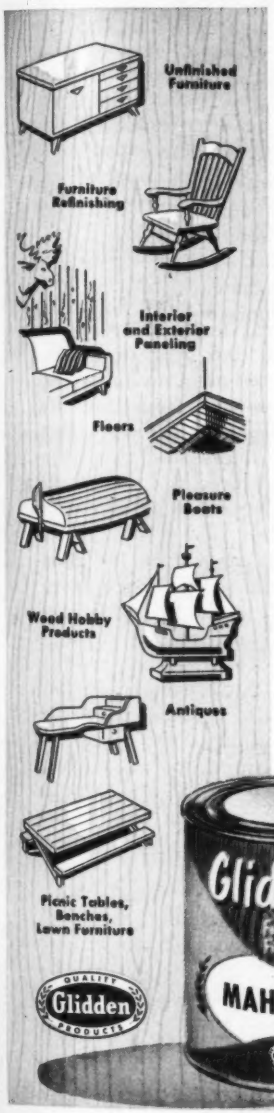
The only tip in applying the paint is to be gentle when you load the brush. Dip it straight in and pull it straight out, without splashing the paint or letting the brush touch the can. This keeps excessive motion from "melting" the paint before you start spreading it.

You can also spray dripless paints, and the non-settling feature is a real advantage here. Once the paints are on, they behave much the same as ordinary ones. The alkyd we used, for example, has the same tough, washable qualities as its drippier brother. END

NEXT MONTH: Read how to lick that summer bugaboo, watering your lawn and garden, by installing an underground system.

Glidden Announces . . .

New GLID-TONE products specially made for do-it-yourself wood finishing



Now Glidden takes the "mystery" out of wood finishing, staining. The new array of Glid-Tone products have "built-in" features for amateur use; give *professional results.* Look for the Glid-Tone label at your paint store.

New, easy-to-use stains in color! Use *Glid-Tone Stains* either inside or out. Seals, does not raise grain. Extremely easy to use—just wipe or brush on, wipe off!

For high gloss and highest resistance to alcohol, acid, heat and abrasion, use all-purpose *Glid-Tone Gloss Varnish* . . . for floors, furniture, table tops, bars, cabinets!

For exterior trim, paneling, boats and marine uses—*Glid-Tone Spar Varnish* is extremely tough, withstands effects of water, salt spray, heat, sun, cold.

For modern, hand-rubbed effects without laborious rubbing, use Glid-Tone Satin Sheen Varnish. Self-priming. No thinners or other extras required.

Glid-Strip—a safe, effective paint and varnish remover. Lets you work larger areas because it stays wet longer. Non-flammable. Cleans up with water!

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Glid-Tone Crystalacq—an all-purpose, crystal-clear brushing lacquer coat for beautifully grained light woods. Dries in only 20 minutes, provides lasting protection. Non-yellowing.

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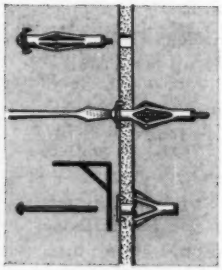

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How They Exposed the Piltdown Hoax

[*Continued from page 123*]

The hoax must have been an inside job—by someone, says Weiner, who "can hardly fail to be among those whose names we know."

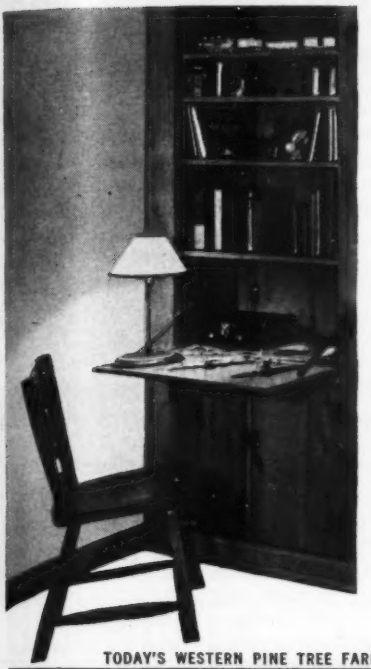
In search of clues, he set out to reconstruct every possible detail of the original happenings. He traveled around the countryside to talk with living eyewitnesses of the famous events, and with relatives and friends of others no longer living. He pored through yellowed journals of the time and, besides the scientific reports of the discoverers, all that was preserved of their correspondence. To Weiner, the resulting mass of evidence clearly exonerates every figure in the Piltdown case but one.

The hoaxer could not possibly have been Woodward, the distinguished British Museum scientist, Weiner concludes; nor Father Teilhard de Chardin, a young Jesuit priest who took part in the excavating. Eliminated are a myriad of less prominent figures—not forgetting the aged and bewhiskered laborer Hargreaves, with the improbable first name of Venus, who was hired by Dawson and Woodward to ply pick and shovel in the gravel pit.

There remains only Charles Dawson, original "discoverer" of Piltdown, who died in 1916 at the age of 52 and at the height of his fame. And while Weiner will not, for lack of "positive and final proof," flatly accuse him, all the circumstantial evidence points to Dawson as the author of the hoax.

A successful lawyer, married, living in the little "county town" of Lewes in a part of southern England rich in fossils, Charles Dawson had pursued his hobby of hunting them with notable success. He had sent Woodward many unusual specimens, including fossils of a dinosaur and a prehistoric mammal of species new to science, which Woodward named after him. So he was already well known and highly regarded in the scientific world at the time of the Piltdown affair.

[*Continued on page 274*]



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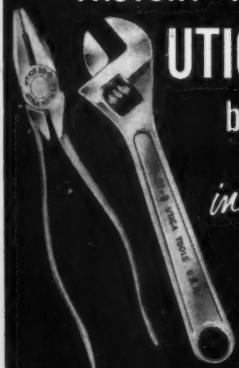

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How They Exposed the Piltdown Hoax

[*Continued from page 272*]

By Dawson's own account, he was walking along a country road leading to a farmhouse near Piltdown Common, when he noticed that the road had been mended with brown flints unusual to the district. He found that they came from a small pit about 100 yards short of the farmhouse, between the road and a hedge, where gravel was dug for road repairs. Finding two farm hands at work there, he asked them if they had come upon any bones or other fossils. They hadn't. He urged them to keep a lookout for such things, and save them for him. On another visit, one of the men handed Dawson a thick fragment of human skull —the first of the "Piltdown" pieces. Later, Dawson says, he returned to the pit and found a larger piece himself. In May, 1912, he journeyed to London and showed Woodward what he'd "found" in the pit by then: skull fragments, fossil-animal teeth, prehistoric flint tools. The extreme antiquity of the animal remains supported a similar date for the human ones.

Woodward's eyes popped. He didn't know that all the principal items Dawson had brought him were faked.

Actually, there was chromium in the skull pieces—telltale evidence of artificial staining with bichromate, for the Piltdown gravel contains no chromium. A fossil-rhino tooth came, not from Piltdown, but from East Anglia where such teeth are not uncommon. A fossil-elephant tooth must have traveled all the way from Tunisia.

Any established fossil collector, Dawson included, would have had little difficulty in assembling these and subsequently found "Piltdown" specimens. The hoaxer could have found some himself, obtained others by trading, or bought specimens in shops catering to collectors. Late Ice Age human skulls aren't exactly common, it's true; but Dawson, for one, is known to have possessed some unusual skulls.

The unsuspecting Woodward, and de

[***Continued on page 276***]

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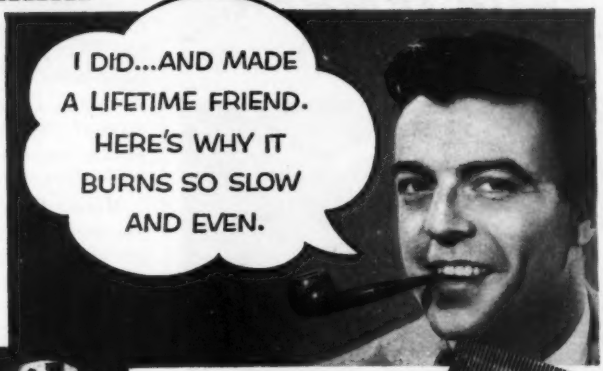

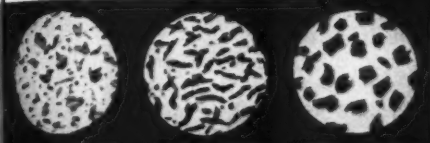

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TRUE TEMPER.

Finest quality in Hammers, hatchets, axes • Garden, lawn and farm tools • Shovels • Shears • Fishing tackle • Golf-club shafts

How They Exposed the Piltdown Hoax

[*Continued from page 274*]

Chardin, joined Dawson in excavating at the gravel pit—with success, if they'd only known it, too good to be true. One summer evening a pick struck the ground, and the faked jaw flew out. First public announcement of the "discoveries" followed, in December, 1912.

Miraculous luck continued to favor the diggers. The last spectacular discovery was no less than a "second" Piltdown man, found, according to Dawson, in a Sheffield Park field two miles from the first site, in 1915. Like Piltdown I, Piltdown II was artificially stained with iron and bichromate.

During this period no one publicly questioned Dawson's honesty. But some of his fellow amateurs, in his home town of Lewes, expressed the opinion among themselves that he was "salting the mine." And a visitor who entered Dawson's office without knocking found him in the midst of some experiment, with bones immersed in crucibles of colored and pungent liquids spread out on his desk. Dawson admitted with apparent embarrassment that he was staining fossils—as he explained it, to find out how natural staining occurred.

The Piltdown "discoveries" ended with Dawson's death in 1916. Undiscourageable, always hopeful, Woodward kept on digging at Piltdown for many years. He never found anything more.

Nevertheless a "new" Piltdown find was to turn up only recently. It was located by Weiner himself—and to some it may furnish the most direct evidence of the hoaxer's identity.

Harry Morris, a bank clerk and flint collector of Lewes, had somehow obtained from Dawson a "Piltdown" flint tool that never reached the British Museum—and had discovered for himself that it was spurious. So A. P. Pollard, a Lewes surveyor and one of Weiner's informants, told Weiner. Morris had died and left his flint collection, including the "Piltdown" flint and notes about it, to Pollard.

[*Continued on page 278*]

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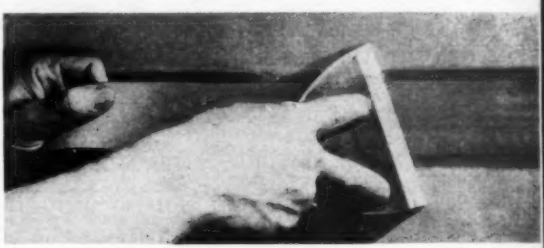

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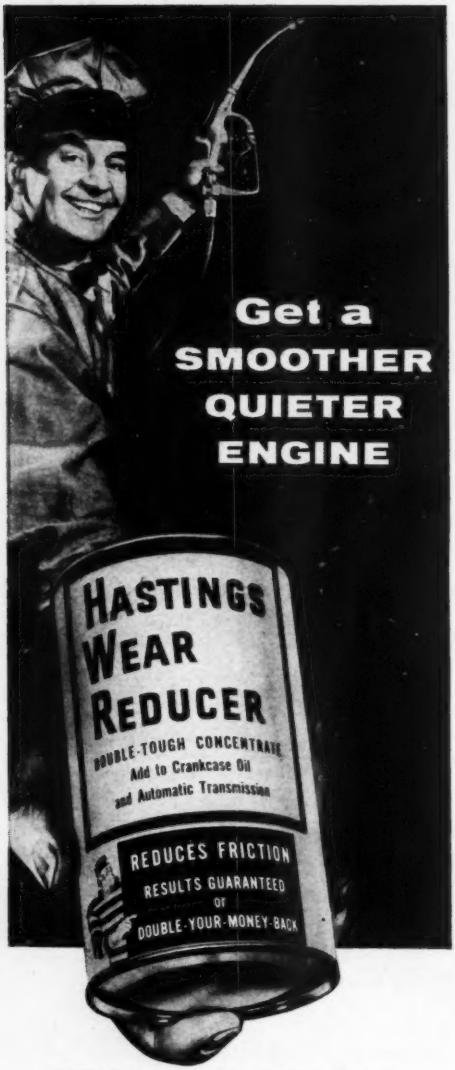

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Wear Reducer, Casite, Piston Rings
Oil Filters, Spark Plugs

How They Exposed the Piltdown Hoax

[Continued from page 276]

Where was the flint now? Pollard had traded the cabinetful of flints to Frederick Wood of Ditchling for a collection of birds' eggs. And Wood, too, had died. But Mrs. Wood still lived in Ditchling; perhaps she still had the missing cabinet.

With a colleague, Weiner hastened to Ditchling. Luck was with them and they found the cabinet, holding 12 drawerfuls of neatly labeled flints. They started with the top one and worked down, their anxiety increasing as they proceeded. The twelfth and last drawer yielded the Piltdown flint. It bore an inscription in Morris' handwriting:

"Stained by C. Dawson with intent to defraud (all).—H. M."

An accompanying note of Morris' repeated the accusation, indignantly adding: ". . . and exchanged by D. for my most valued specimen!"

A second note declared that hydrochloric acid would remove the brown color, leaving one of the relatively common white flints found on the Chalk Downs of Lewes. Morris was right about that, Weiner found.

And whatever the merits of Morris' direct accusation of Dawson, it has become a part of the official record of the case—for the "Morris flint," inscription and all, now reposes in the British Museum.

The fantastic Piltdown case seems closed—except for the puzzle of the hoaxer's motive. He gained nothing in money; the specimens were presented to the British Museum. Was fame his object? Was the deception an intended joke that went too far? Whatever prompted the impostor lies beyond reach of chemical and physical tests—and perhaps must remain always a mystery. END

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ITEM #160—Especially designed for belt drive from fan belt, power take-off, drive pulley, electric motor or small gas engine. Equally suitable for direct coupling. Pedestal type mounting with two bolt holes for ⅜" hold-down bolts. Standard ¼" pipe thread inlet and outlet ports. Delivers 4.5 GPM at 1000 PSI at 2800 RPM with 4 HP. Hardened steel gears turn in dense oilite bronze bearings. Rotation—clockwise facing shaft. Guaranteed trouble-free service. Ship. wt. 6 lbs. F.O.B. Chicago **22.50**

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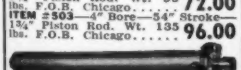

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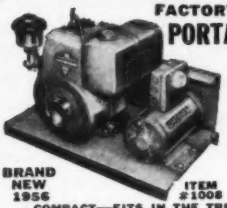

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1000 WATTS OUTPUT, continuous duty. 115 Volts A.C. 60 cycles, 9 amps. Powered by husky, easy starting Clinton engine. Engine and generator operate at 3600 R.P.M. for maximum efficiency at minimum weight. Both units are mounted on steel base, with heavy sheet metal belt guard. Generator is self regulating, and is equipped with outlet box containing fuse and 2 A.C. convenience receptacles. Cost only 5c an hour to operate. Dimensions: Length 20½", Width 12", Height 16". Shipping wt. 100 lbs. F.O.B. Chicago..... **149.50**

700 WATT—GENERATOR SET—same as above, slightly smaller—with Briggs-Stratton Engine—Model 708—F.O.B. Chicago..... **129.50**

ITEM #2008 **2000 WATTS** 115 V. A.C. generator set, powered by husky, fast starting Briggs-Stratton engine. Mounted on portable steel carrying base for easy handling.—Just right for small cottage and cabins needing inexpensive 2000 Watts of electricity. Ship. Wt. 190 lbs. F.O.B. Chicago **295.00**

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HYDRAULIC REMOTE CONTROL SET

Item #415—Designed for remote operation of controls on engines, boats, special machinery, etc. Eliminates complicated mechanical linkages, cables, pulleys, etc. The master unit connects to the slave unit with a single ¼" tube. When master control lever is moved, slave lever follows exactly. Light, compact, aluminum alloy construction. Dim. of both units: 5¼ W, 9" H, 1¾" D, (exclusive of handle) Ship. Wt. 8 lbs. F.O.B. Chicago.. **27.50** per pair

(Note—tubing not supplied)

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OUTPUT SHAFT

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Item #104A — A fine pump for gasoline, fuel oil, water, kerosene. For fuel transfer, sump pumping, for draining basements. Capacity, 400 gallons per hour. ¾" pipe thread inlet and outlet. Has built-in, adjustable relief valve, set at 30 P.S.I. Adjustable to 100 P. S. I. Rotation in either direction; use ⅓ Hp. motor; ½" standard shaft, ball-bearing supported. Dimensions: 5½" x3½x10". Shipping weight 8 lbs. **A $55.00 VALUE** F.O.B. Chicago **16.50**

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These all bronze Centrifugal Pumps are ideal for use as marine bilge pumps, circulating pumps, fire protection or irrigation, car-washing, dewatering, basement sump pumping, lawn sprinkling. Will pump water, oil, brine, gasoline, DDT and sulphur compounds. Equipped with 6" adjustable "V" pulley, 2" dia. inlet and outlet, 180 GPM capacity. Inlet and outlet take hose with 2¼" inside diameter. Dimensions: 11" x 8" x 11".

Total head-feet	Speed	H.P.	GPM
25	3600 RPM	3	180
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Back plate may be rotated for most convenient inlet position. Gov't. acquisition cost $96.00. Shipping weight 31 lbs. F.O.B. Chicago.... **29.50**

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Why They Want to Shift the Keyboard

[Continued from page 135]

much as 95 percent over the old board.

Tonnage. To carry those roving fingers 20 miles, today's girl actually moves 500 tons a day. When she jumps between rows, Tom Booz tells her, she pushes not a few ounces—but 6½ pounds (finger, hand, and part of her forearm). Most of this lifting is done as her fingers move from one row to another. But on the simplified keyboard, with all the most-used letters on one line, there is very little moving from line to line. The girl's weight-lifting for her eight hours, therefore, shrinks from 500 tons to 60 or 70 tons—a reduction of up to 70 percent.

These things, together with the virtual elimination of leapfrogging from the bottom line of letters to the top one, mean that at the end of a day a girl's arm and back muscles and tendons are not so tired.

If this isn't enough, Booz tells of women who have already been reformed by the new keyboard:

Mrs. Lenore Fenton MacLain. She has done 165 net words per minute on an electric typewriter with the Dvorak arrangement of letters, and has maintained this average for an hour. She won so many speed contests a while back that she canceled a lot of other contests. There was no point in holding them.

Mrs. Mary V. Kerzner of Hollis, N.Y. A public stenographer, she first switched her portable from standard to Dvorak keyboard. She liked it so much that she had her electric switched over. Her first job thereafter was typing a 90-page thesis on electronics. "It was tough," she says. "But I was stubborn." By now she has increased her words per minute from 77 (standard electric) to 130 (Dvorak electric), virtually doubling her income.

Mrs. Kerzner's present electric machine, with Dvorak keyboard, is a Chinese red in color with pearl-gray keys. "I have to work for a living," she says, "so I have done everything possible to my machine to enjoy it."

The U.S. Navy took 14 girl typists (who knew the standard keyboard),

[Continued on page 282]

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HEAVY DUTY FAN. Semi-enclosed motor suitable for spray booths, restaurant exhausts, poultry houses, etc. 10" Fan, wt. 8 lbs. (Item 10E) $11.95
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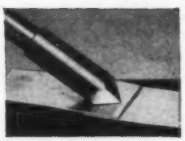

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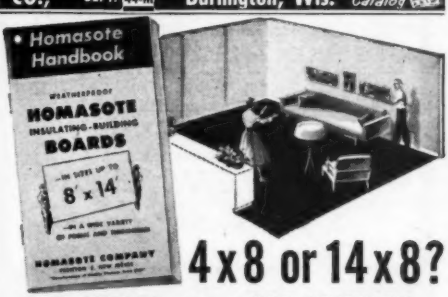

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Do the job easier and better with GREENLEE tools. Auger bits, electric-drill bits, other boring tools, chisels, gouges, spiral screw drivers, push drills, and many more. All expertly made of top-quality materials for long life, fine results. At leading hardware and building supply dealers. Write for folder, Greenlee Tool Co., 2124 Columbia Avenue, Rockford, Illinois.
TOOLS FOR CRAFTSMEN
GREENLEE

Why They Want to Shift the Keyboard

[Continued from page 280]

gave them an average of 83 hours of training on the Dvorak, and increased their net words—that includes subtraction for errors—per minute from 33 to 57.1, or well above the average of all U.S. typists. The Navy girls had a 25 percent increase in gross speed, a 68 percent reduction in errors, and a whopping 74 percent increase in net words per minute.

Dr. Dvorak today is using his royalties to get the new keyboard into schools, where children will be exposed to it from first grade up. This means that the girls and boys will get it before they are exposed to the standard keyboard, and therefore before they build up resistance to the simplified version. Results so far are good:

First-grade school children (who were tested on the Dvorak keyboard in 20 cities) quickly learned to type simple words with it. This is mainly because they can make so many words from the single home row of letters. The youngsters are fascinated by the keyboard, because, Booz thinks, of their ability to use it so quickly, and they stay with it—they want to keep typing throughout early grades.

> ***Experience is never more valuable to a man than when it permits him to do a tough job right the first time.***
>
> —THE SIDEWALK SUPERINTENDENT

Tacoma, Wash., junior high schoolers in one year attained faster typing speeds with the Dvorak keyboard than their classmates did in three years with standard machines. And, like the first graders, they stick with the simplified typewriter, while, over the U.S., 45 percent of the high schoolers in regulation typing courses give up.

If they get the girls young enough, Booz figures, they will reform the nation's secretaries; if they catch the boys young enough, they will also—which will please today's secretaries—reform the boss.—*Gardner Soule.*

ARMY PILOT'S BRIEFCASE

Made to Gov't Standards. Genuine leather with heavy duty zipper around three sides. Fabric lined and has five large inner pockets. Size 17" x 13". New. 3.75 EA

SOUND POWER PHONES

Originally used by the Navy for gun control. Ideal for emergency communication because each set is 'sound powered'. Will operate up to 1/2 mile distance. Set includes 2 phones on chest plate, 2 headsets, apprax., 35 feet of wire. 9.95 PER SET

RS 38A MICROPHONE

Carbon type with push-to-talk button. Ideal for use where background noise is high. Can be operated with 1½V drycell. Comes 6 ft., 3 conductor, shielded cable & plug. 2.49

HS-30U Signal Corps HEADSET—Low impedance. Two earphones & band. . . 3.45

STEEL FRAME BRITISH PACK RACK

Has extra lightweight tubular steel frame. Originally designed for British Army Mountain troops. Frame has fold-down pack shelf at bottom. Rack is designed so that weight is carried at hips. Weight only 2-1/2 lbs. Folds flat when not 4.50

17" LONG ARMY MACHETE

Has 22" Vanadium steel blade. Hardwood handle. 27" overall. Complete in rugged belt sheath. 1.98

PORTABLE SHOVEL

Has 29" hardwood handle. Blade folds to form pick or shovel. Ideal for emergency. 1.75

SURPLUS HOISTS

5 TON HOIST

SHOP VALUE 69.95

A real heavy duty Hoist. Mfd. by the Seattle Chain & Mfg. Co. Crank operated. Has two speeds, one for rapid lift – other for heavy duty. Drum size: 8-3/8" x 5" diameter. Complete with hand brake and handle.

5 TON WINCH HOIST – With crank type handle and ratchet brake. In excellent condition. Ideal for truck or jeep mounting. 39.95

10 TON WINCH HOIST – Has 17" drum. Used by Signal Corps. In good condition. With brake and handle. 89.50

$80.00 VALUE

HOIST

ONLY 32.50

Lifts 2500 lbs. with 24 to 1 gear ratio. Bronze worm gear drive. Has 18 ft. of 3/16" steel cable.

PORTABLE WINCH HOIST

A 'swing around' type hoist. Will lift up to 1500 lbs. with 21 to 1 gear ratio. Has 12ft. of 3/16" steel cable. 40" arm with 3" pulley. 22.50

NEW 4-SPEED HOBBY MOTOR

Has four take-off shafts turning at 5, 25, 150 & 4000 RPM. Operates on 110 volt 60 cycle current. Ideal for home shop, barbeque. 9.95

NOW! A PROVEN FACT – SAFETY BELTS SAVE LIVES

NYLON AUTO SAFETY BELTS

MADE TO WITHSTAND A CRASH PRESSURE OF 3000 POUNDS

Meets CAA standards. Approved by Police, Safety Councils, Highway Patrol, Fleet Operators, etc. Made of finest NYLON webbing and fitted with Aircraft type buckle. Easily installed in any car. Special sizes for Sports Cars. Available in the following colors: Blue, Green, Gray and Maroon.

HOLDS YOU IN YOUR SEAT

INSTALL IT IN ½ HOUR

PREVENTS THIS IN A CRASH

99.5 VAL. ONLY 4.89 EACH SPECIFY COLOR AND ALTERNATE COLOR

5 SECONDS TO FASTEN – 1 SECOND TO UNFASTEN

SAVE 50%

PHILIPPINE MAHOGANY LUAN PLYWOOD AT LESS THAN WHOLESALE

For Paneling Dens, Offices, etc. Use in Cabinets, Furniture, etc. Rotary cut. Both sides sanded. Bonded with finest resin adhesive. Face side unjointed. Shipped at lowest rates.

3MM (⅛") x 3FT. x 6 FT. $5.09 VALUE 1.79 PER SHEET MINIMUM ORDER 6 SHEETS

FREE SAMPLE ON REQUEST

¼" x 4FT. x 8FT. 9.50 VAL. MIN. ORDER 4 SHEETS 4.49 PER SHEET

HARDWOOD LEGS with BRASS TIPS

Beautifully turned, fully seasoned hardwood legs. Smoothly sanded and complete with brushed Brass tip and sturdy steel mounting plate. Available Finished or Unfinished – Finished units come in Blonde, Silver Fox, Mahogany or Charcoal Black. Please specify finish.

Price per set of 4 with Brass tip.

SIZE	FINISHED	UNFINISHED	SIZE	FINISHED	UNFINISHED
4"	$2.65	$2.15	14"	$4.40	$3.95
6"	3.00	2.65	16"	4.75	4.40
8"	3.55	3.00	18"	5.35	4.75
12"	3.95	3.55	28"	6.25	5.35

NEW 60-450X MICROSCOPE

FEATURING 60, 120, 150, 180, 300 AND 450 POWER MAGNIFICATION

NEWLY DEVELOPED—Self-Contained SUB-STAGE LIGHT ELIMINATES NEED FOR EXTERNAL LIGHT SOURCE

Take advantage of our tremendous foreign purchase. Ideal for use by Amateur Scientist, Student, in Home Laboratory for study of insects, plant life, etc.

CHECK THESE FEATURES

1 - Triple, revolving turret with 10X, 20X, 30X precision ground & polished lenses.
2 - Two interchangeable eyepieces, 6X and 15X with precision ground and polished lenses.
3 - SIX MAGNIFICATIONS for all purposes – 60X, 120X, 150X, 180X, 300X and 450X.
4 - NEW! Sub-stage with SELF-CONTAINED LIGHT. No external light source needed.
5 - Large sub-stage mirror for use with external light sources.
6 - All Metal Body – inclines through 90 degrees.
7 - Special Hardwood Case and 3 glass slides.

SUB STAGE LIGHT

FREE! with MICROSCOPE – 8 Pc. DISSECTING SET with hardwood case. 12.95 MICROSCOPE AND DISSECT SET

NEW Special 12 Pc. SPORTSMAN'S KNIFE

4¾" BONE HANDLE

Eliminates 12 Items from Pack or Tool Kit

ONLY 4.95

Contains a regular knife, a fork, a spoon, scissors, draw knife, bone saw and fish scaler, can & bottle opener, cork screw, awl punch, screwdriver, and metal file. Mounted in a rugged bone handle.

COMPLETE WITH LEATHER BELT CASE

FAMOUS PALLEY MIXES

GADGET MIX – Consists of 5 pounds of Rivets, Spacers, Bolts, Screws, Gears, Wheel Bearings, Springs, Clamps, and many more. ALL for ONLY. . . 1.49

BEARING MIX – Approximately 20 needle and Ball and Roller bearings. New and Used. Sizes: 1/2" to 4". Some of these cost the Gov't $10 apiece. Never such a value. 5 lbs. ONLY 1.59

FILE MIX – Ten assorted Files, 4" to 12", includes 3 Vixens, half rounds bastards, mills, etc., in seconds and used but in good condition. 1 Vixen alone worth our price for entire mix. F-1 1.99

PULLEY MIX, No. PM-1 – You'll want this one around. 10 micarta & metal pulleys ranging from 1" to 5" with ball and one piece bearings. These are aircraft pulleys, the best made with 100's of uses. A WONDERFUL BUY!!! 2.95

300 FOOT ANTENNA

Can be trimmed to 80 METER SW Band with up to 75 feet lead-in. Stranded copper with ayelet and. A BUY AT 1.49

SIGNAL CORPS WHIP ANTENNA Ideal for use with auto or portable radios. Can be used with FM receivers. Telescoping type, from 12" to 7 feet. 1.49

REFLECTOR AMTENNA

Originally used in Radar. Can be adapted to TV or FM use. Webbing is fine mesh monel wire. Overall span 44 inches... 1.49

65 to 3 GEAR DRIVE

A precision gear drive for light, accurate work. Has a 65 to 3 gear ratio. Gears rotate on self-lubricating ball bearings. Shafts are 1/2" & a 2" coupling plate. 9.95

180° OFFSET DRIVE

NEW

For use where tremendous power at low take-off RPM is desired. 6 gears rotate on self-lubricating, hi-speed roller bearings. 85 to 1 gear ratio. Shafts are 1/4" & 3/8" dia. USED 5.95 NEW in excellent condition . . . 8.95

PRESSURE TANKS

GI Type Stainless Steel. Shatterproof and rustless. Has reinforcing ribs and is pressure tested up to 400 PSI. Has high safety factor. 1/4" pipe ports. Ideal for use in air supply in underwater fishing, painting, spraying, etc. Also as buoy or for water supply. Size: 12½" x 24". Stainless Steel. . . 12.95

Corrosion Resistant Steel TANK – No. D-2. 200 cu. in. capacity. . . 3.95

PALLEY HYDRAULIC BUY

One of our many Hydraulic Bargains. Use for opening & closing doors, etc. 1500 PSI constant – 3000 PSI intermittent. Will lift or push 1100 lbs. Has adjustable stroke from 2½" to 4". Bore 1". Shaft 5/8". 5.75

SAVE 50% ON PALLEY HYDRAULICS

NEW

For far our Special HYDRAULIC CATALOG SUPPLEMENT – Shows the entire line of our New Hydraulic Equipment designed especially to fill the needs of Industry. Also shows our regular line of War Surplus Hydraulics such as pumps, valves, cylinders, fittings, etc. at SAVINGS UP TO 85%. Write today. It's FREE!

Palley's

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Order From This Ad. Pay by M.O. or check. P.O.'s accptd. from D&B firms. 25 deposit with C.O.D.'s. All Prices FOB Los Angeles

[*Continued from page 117*]

transistors and extensive use of printed circuits are expected to trim the price tag eventually.

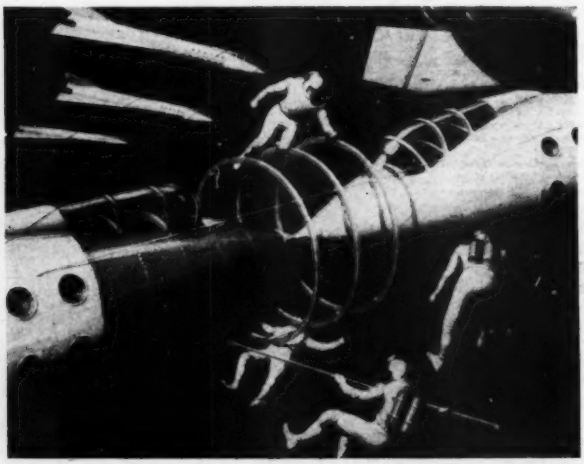
Safety. To the undisguised relief of many Detroiters, 1956's big push on safety does not seem to have repelled the customers. Next year, the same advertising themes will continue, though at a lesser pace. Changes for improved safety will probably include relocating some ignition keys and parking-brake handles away from areas where they can cause severe knee injury in crashes.

Outside door handles on many cars will be recessed. The plan for Chrysler-built cars calls for a depression bridged by a crossbar. Lifting up and out on the bar unlatches the door.

More boudoirs. Hard-shelled guys who think cars are just transportation machines will find little solace in '57. Metal-flecked upholstery, multihued colors, and the general air of a rolling harem will continue. There will be further use of the new acrylic lacquers. (These are already appearing as an extra-cost option on some GM cars.) The new lacquers are reportedly capable of holding gloss and color three or four times longer than present finishes. Better yet, they go well with showy metallic-powder pigments. As an engineer for a competitive company says, ruefully: "They're putting out the kind of colors we think we're lucky to get on our dream cars."

Tain't so. A number of Detroit rumors seem to be *not* true at this writing: The new Ford Motor Company car, aimed at the gap between Mercury and Lincoln, will not be called the "Edsel" and it will not be out in the fall of this year. Disk brakes, though under study at many proving grounds, are evidently not ticketed for '57 production, on the theory that there is still development room with drum brakes. The soft-top and four-door Mark II Continentals will not be ready this fall, and the Mark III is not currently scheduled before 1960.—*Frank Rowsome Jr.*

NEXT MONTH . . . How They'll Build a City in Space



SPACE travel has been accepted by the scientists and they have gone on to think of space *living*. At left is one of the many startling illustrations from a seven-page article—four in full color—that gives the details of how a huge sky city, housing thousands of people, might be built. It is based on an engineering study by Darrell C. Romick, of the Goodyear Aerophysics Dept. Watch for it in the May issue of POPULAR SCIENCE MONTHLY.